National Library of Canada
Bibliothèque nationale du Canada

Canadian Theses Service
Service des thèses canadiennes

Ottawa, Canada
K1A 0N4

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, tests publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30.

NL-339 (r. 88/04)

Canadä

THE UNIVERSITY OF ALBERTA

THE APPLICATION OF A PROCESS BASED APPROACH TO THE REMEDIATION OF SPELLING

©

BY

FERNE SPENCER

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND
RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF EDUCATION

IN
SPECIAL EDUCAITON

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA
FALL, 1987

Permission has been granted to the National Library of Canada to microfilm this thesis and to lend or sell copies of the film.

The author (copyright owner) has reserved other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without his/her written permission.

L'autorisation a été accordée à la Bibliothèque nationale du Canada de microfilmer cette thèse et de prêter ou de vendre des exemplaires du film.

L'auteur (titulaire du droit d'auteur) se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation écrite.

ISBN 0-315-40876-6

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: FERNE SPENCER

TITLE OF THESIS: THE APPLICATION OF A PROCESS BASED APPROACH TO THE REMEDIATION OF SPELLING

DEGREE: MASTER OF EDUCATION

YEAR THIS DEGREE GRANTED: 1987

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

Ferne Spencer
(Student's signature)

25 Glenwood Crescent
St. Albert, Alberta

Date: September 18, 1987

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled THE APPLICATION OF A PROCESS BASED APPROACH TO THE REMEDIATION OF SPELLING submitted by FERNE SPENCER in partial fulfillment of the requirements for the degree of MASTER OF EDUCATION.

J P Das
(Supervisor)

Moira J Juliebö

Fern Snart

Date: September 18, 1987

THIS THESIS IS DEDICATED TO ALL THE LEARNING DISABLED STUDENTS WHOSE LIVES I HAVE BEEN APART OF.

Abstract

The purpose of this study was to measure the effect of an intervention program which combined Das and Conway's (1986) remedial program, CAP (Coding, Attention and Planning Training) with a spelling program (designed to reflect the principles embedded in the specific CAP tasks), on the students' ability to spell words correctly.

Twenty learning disabled subjects between the ages of eight and twelve participated in this investigation. All of the students experienced difficulties in spelling and were selected from an elementary school that housed two special education classes for learning disabled children. One class of ten represented the experimental group and the other the Control Group.

Each lesson of the intervention program consisted of ten minutes of CAP training, twenty minutes of spelling activities and five minutes for a cummulative spelling test for a total of thirty minutes. Daily performances on the CAP training and spelling sessions were recorded. The intervention program continued until each student received twenty hours of remediation. The CAP tasks utilized included Task 10 (Bead Threading) Task 11 (Serial Recall), Task 13 (Syntax Task), Task 16 (Telephone) and Task 18 (Joining Shapes).

The spelling tasks were modelled after the task demands within each of these CAP tasks. The words used for the remedial program were selected from lists of frequently used and misspelled words at the appropriate grade levels for the subjects. It was hypothesized that following intervention there would be greater improvement for the Experimental Group than the Control Group on the (1) Cognitive Assessment System planning subtests, (2) the Kaufman Assessment Battery for Children's mental processing subtests and (3) the Test of Written Spelling.

Analysis of data revealed that the Experimental Group's performance was significantly better than the Control Group on the following measures: (1) Cognitive Assessment System's planning subtests; Planned Connections, Crack the Code and Automatic Search items; (2) Kaufman Assessment Battery For Children's Successive Subtests and (3) Test of Written Spelling.

These findings can be attributed to the intervention program and suggest a viable option for the remediation of spelling for the learning disabled child.

Acknowledgements

I wish to express my gratitude to my supervisor, Dr. J. P. Das for the guidance and assistance he provided throughout the study.

Sincere appreciation is extended to Dr. F. D. Snart for her interest, valuable suggestions and encouragement.

Thank you is also expressed to Dr. M. F. Juliebo for her suggestions and discussion related to this thesis.

A very special thanks and sincere appreciation are extended to Audrey Dalzell who was instrumental in bringing this study about. Her dedication and commitment were vital factors in the success of this study. The encouragement, support, and understanding she provided for me made the task at hand less formidable.

Thanks are also extended to all of the students who participated in the study.

Special thanks are extended to Jean Clelland and Joan Gibson who provided continual support and understanding through all phases of the study.

My most sincere appreciation is extended to my husband Wynn and to my family for believing in me. Their patience and encouragment guided me through all aspects of this study.

TABLE OF CONTENTS

CHAPTER PAGE

I. INTRODUCTION.............................. 1

II. REVIEW OF RELATED LITERATURE............. 6
   Introduction.............................. 6
   Learning Disability: A Movement Toward Operationally Defined Subgroups......... 6
   The Speller and the Spelling Process..... 13
   Information Processing Models of Spelling Behavior...................... 13
   The Simultaneous and Successive Model.... 19
   Implications of the Simultaneous and Successive Model for the Learning....... Disabled.............................. 23
   Spelling Difficulties of the Learning Disabled.............................. 26
   Remediation Methods Used With Learning Disabled.............................. 33

III. RATIONALE, HYPOTHESES, AND DEFINITIONS... 38
   Rationale For Study...................... 38
   Hypotheses............................... 40
   Definitions.............................. 44

CHAPTER PAGE

IV. METHOD AND PROCEDURES........................ 46

Introduction............................ 45

Selection of Subjects................... 46

The Pre-test Battery.................... 47

The Intervention Step................... 59

Post-test Battery....................... 59

The Intervention Program............ 60

Preparation and Organization of Material...................... 60

Organization of the Classroom..... 74

Organization and Scheduling of the Remediation Program.......... 74

Record Keeping.................... 76

Description and Instructions For the Global Tasks................. 76

Description and Instructions For the Spelling Tasks............... 83

V. RESULTS AND DISCUSSION.................... 96

Process Improvement.................... 96

Successive Processing Measures...... 96

Simultaneous Processing Measures.... 102

CHAPTER PAGE

Cognitive Assessment System
Measures.......................... 108
Spelling Improvement.................. 126
Test of Written Spelling Measures... 126
Spelling Program.................. 137

VI. CONCLUSION............................. 158
Introduction.......................... 158
The Study and Related Findings......... 158
Implications for the Learning
Disabled.............................. 160
Implications for the Teacher of the
Learning Disabled.................... 163
Implications for Future Research 165
A Final Word.......................... 167

BIBLIOGRAPHY.............................. 168

APPENDIX A. Students' Reading Levels..... 173

APPENDIX B. Tests........................ 175

CHAPTER PAGE

APPENDIX C. The CAP Tasks............... 242

APPENDIX D. Samples of Students'
Written Expression.......... 267

List of Tables

Table Page

1. T-Tests (Independent Samples): Differences Between the Means of the Experimental and Control Group on Age, I.Q. And Grade Score Equivalent on the Schonell Spelling Test (Form A) 48

2. Pre and Post-Test Means and Standard Deviations for the K-ABC Sequential Subtests for Both the Experimental and Control Groups 98

3. Two-Way Analysis of Variance with Repeated Measures (Pre,Post) for the K-ABC Sequential Subscale 99

4. T-Tests (Independent Samples): Differences Between the Pre-Test/Post-Test Means for the Experimental Group and the Control Group on the Sequential Subscale 101

5. Pre-Test and Post-Test Means and Standard Deviations for the K-ABC Simultaneous Subtests for Both the Experimental and Control Groups 104

6. Two-Way Analysis of Variance With One Repeated Measure (Pre/Post) for the K-ABC Simultaneous Subscale 105

7. T-Tests (Independent Samples): Differences Between the Pre-Test/ Post-Test Means for the Experimental Control Group on the Simultaneous Subscale 107

8. Pre-Post Test Means and Standard Deviations for the Planning Subtest Visual Search for Both the Experimental and Control Groups 110

Table Page

9. Hotelling 2-Sample T**2 Test: Differences Between the Pre-Test Means of the Experimental and Control Group on the Visual Search Subtests 111

10. Pre-Test and Post-Test Means and Standard Deviations for the CAS Planning Subtests: Crack the Code and Planned Connections for Both the Experimental and Control Groups 112

11. T-Test (Independent Samples): Differences Between the Pre-Test Means for the Experimental and Control Group on the Crack the Code Subtest 113

12. Hotelling 2-Sample T**2 Test: Differences Between Pre-Test Means for the Experimental and Control Group on the Planned Connections Subtest 114

13. Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) For Automatic Search (Picture Among Number Plus Number Among Picture) 117

14. Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) For Total Control Search (Number Among Number, Picture Among Picture, Letter Among Letter) 118

15. Two-Way Analysis of Variance With One Factor Repeated (Pre/Post) For Crack the Code 119

16. Two-Way Analysis of Variance With One Factor Repeated (Pre,POst) for Planned Connections Subtest (Items Seven Plus Eight) 120

Table Page

17. Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) for Planned Connections Subtest (Item Nine Plus Ten) 121

18. T-Tests (Independent Samples): Differences Between Pre-Post Test Means for the Experimental Group on Total Automatic Search, Planned Connections (Items 7 Plus 8) and Crack the Code 123

19. T-Tests (Independent Samples): Differences Between Pre-Post Test Means for the Control Group on Planned Connections (Items 7 Plus 8) and Crack the Code 124

20. Pre-Test and Post-Test Means and Standard Deviations for the Test of Written Spelling for Both the Experimental and Control Groups 128

21. Analysis of Variance for the Test of Written Spelling 130

22. Analysis of Variance with One Factor (Pre-Post) for the Predictable Subtest 134

23. Two-Way Analysis of Variance With One Factor (Pre-Post) Repeated for the Unpredictable Subtest 135

24. Spelling Scores Combined Over Two Days 138

25. Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 139

26. T-Test (Dependent Sample): Difference Between the Means of the First Eight Blocks and in the Second Eight Blocks 152

Table Page

27. Mean and Standard Deviations for Spelling Blocks One to Seventeen 153

28. Analysis of Variance with Repeated Measures for Spelling Blocks One to Seventeen 154

29. T-Test (Dependent Sample): Difference Between the Means of the Thirty-Fourth and Thirty-Fifth Test Scores 155

List of Figures

Figure		Page
1.	Planned Connections: Items Nine Plus Ten Mean Scores on Pre- and Post-tests for the Experimental and Control Groups	116
2.	Test of Written Spelling. Mean Scores on Pre- and Post-tests for the Experimental and Control Groups	129
3.	Test of Written Spelling. Mean Scores on Pre- and Post-tests for Predictable Words for the Experimental and Control Groups	132
4.	Test of Written Spelling. Mean Scores on Pre- and Post-tests for Unpredictable Words for the Experimental and Control Groups	133
5.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 For Student One	140
6.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Two	141
7.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Three	142
8.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Four	143
9.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Five	144
10.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Six	145
11.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Seven	146
12.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Eight	147
13.	Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Nine	148

Figure Page

14. Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Ten 149

15. Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for The Total Group 150

16. Retention of Spelling Performance for The Total Group After A Two Week Break From Remediation 156

CHAPTER I

INTRODUCTION

"Some children are just born poor spellers"
(Flaro, 1985, p. 4)

"The ability to spell well is a gift from God"
(Lerner, 1981, p. 337)

The above expressions illustrate the attitude many educators have in regard to spelling ability. They imply a theory of innate ability and suggest that educators are, to an extent, not accountable for the success or failure of their students' ability to spell well. Indicative of this attitude is the limited focus placed on spelling as a curriculum area in the elementary schools. "In comparison with reading, spelling has received little attention by educators" (Wallace & Larsen, 1978, p. 363). "Teachers spend very little time actually teaching spelling" (Gerber & Hall, 1987, p. 34), and when they do "...they disregard empirically valid techniques for teaching spelling even when they are aware of those techniques" (Gerber & Hall, 1987, p. 34).

Apparently teachers do not have greater success teaching spelling today than they did years ago (Gerber & Lydiatt, 1984).

According to Hammill and Noone (1975) "Spelling is a tool subject and deficits in this skill can influence the child's entire school experience". (p. 90) Written communication would be one such area significantly affected by spelling difficulties. "Poor spelling certainly distracts from the effectiveness of any form of written communication" (Wallace & Larsen, 1978, p.363).

Proficiency in written communication has become a societal concern. This is reflected in the writing competence tests students are required to write prior to entering universities in Alberta and serves to illustrate the necessity for educators to learn more about the spelling behaviors of their students.

"Because reading and spelling are closely related, learning in reading has direct consequences for learning to spell" (Wong, 1986, p. 169). Consequently, the reading disabled invariably have difficulty learning to spell (Gerber, 1984; Rieth, Polsgrove & Eckert, 1984; Englert, Hiebert & Stewart, 1985; Wong, 1986; Gerber & Hall, 1987), "...thus impeding their ability to express themselves fluently in written communication" (Gerber, 1984, p. 49). For these students spelling problems persist "...as a serious deficiency through secondary school" (Gerber & Hall, 1987, p. 35).

In addition to the academic implications of spelling difficulties there are affective implications. The emotional burden of this deficit is alluded to in Harte's (1957) poem "The Spelling Bee At Angels". Harte (1957) writes of the children returning home with "downcast heads and downcast hearts". (p. 82) The reading disabled student would especially be vulnerable to this emotional burden. "Ability to spell is often regarded as evidence of scholarly achievement. Justifiably or not, incorrect spelling often creates an unfavorable impression beyond its true significance" (Otto & McMenemy, 1966, p. 203). The written work of the reading disabled would be an obvious reminder of their failings and all too often serve to influence their personal esteem.

Initially, traditional spelling programs were the only viable option available for the reading disabled student. The majority of these programs reflected a linguistic theory whereby emphasis was placed on the teaching of phonology, morphology and syntactic rules (Hammill, Larsen & McNutt, 1977). For most reading disabled students these programs proved to be ineffective. As a result, remedial spelling systems were developed to accommodate students who demonstrated spelling deficits. There exists a vast array of these programs and according to research, some of them have proven to be effective (Gerber & Lydiatt, 1984). However, there is a scarcity of research in the area of spelling remediation for reading disabled students and knowledge regarding the most effective remedial programs remains limited.

In summary, reading disabled students are at risk both academically and emotionally as a result of their spelling deficits. Research in the area of instructional practices for the reading disabled appears to be insufficient. In view of the fact that spelling presents the reading disabled student with extraordinary obstacles (Gerber & Lydiatt, 1984), there is a need for further research in the development of effective intervention programs to remediate the spelling behavior of these students.

The goal of this study was to design and test an instructional procedure that facilitated reading disabled students' "ability to arrange properly, letters into words that are necessary for effective communication" (Wallace & Larsen, 1978, p. 363). The practical application of this intervention within a teaching environment was evaluated in terms of its effectiveness.

A general review of related literature is addressed in Chapter Two. The rationale, hypotheses and definitions for this study are presented in Chapter Three. Chapter Four provides a description of the method and instructional strategies employed for this study. The results of this research are described and discussed in Chapter Five. The implications of the results are presented in Chapter Six.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

This literature review is divided into two sections. The first section deals with the definition issue related to research in the field of learning disabilities. The review of this issue provided the basis for a definition of the learning disabled students to be utilized within this study. The second section examined the speller and the spelling process in order to determine the nature of the spelling problems experienced by these children. The Simultaneous-Successive model which provided the framework for this investigation is also discussed within this section.

Learning Disability: A Movement Toward Operationally Defined Subgroups

Learning Disabilities is a relatively new area of special education, having been identified only in the late 1960's. From the beginning, the "learning disability" concept evoked much controversy among professionals and, to date, no one definition of "learning disabilities" has been accepted. Definitions and classifications differ depending upon whether they are based upon a medical, or educational model or whether they are based primarily on cause, symptom or treatment (Gaddes, 1980). Many definitions contain the following components:

1. A discrepancy exists between ability and actual achievement;

2. A child has one or more significant deficits in essential learning processes to the point where special education becomes necessary;

3. The learning disability referred to is not primarily the result of a sensory, motor, intellectual or emotional handicap, or the result of the lack of opportunity to learn.

The definition responsible for the development of special education programs and teacher training was United States Public Law 94-142 passed in 1977.

> The term "children with specific learning disabilities" means those children who have a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such disorders include such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, or mental retardation, of emotional disturbance, or environmental, cultural, or economic disadvantage.
> (Hammill, Leigh, McNutt, Larsen, 1987, p. 109)

The National Joint Committee for Learning Disabilities (NJCLD) (1981) attributes many widespread problems to this definition. A critical review by the NJCLD (1981) cites four major problems resulting from the interpretation of this definition. First, through misinterpretation, people tend to view learning disabled children as a homogenous group whereby a standard approach to assessment and programming can be applied. The committee believed that this conclusion was incorrect and urged the recognition of learning disabilities as a heterogeneous group of disorders and advocated the concept of subgroups existing within the learning disabilities population.

The use of the word "children" in the definition was the second issue addressed. The committee suggested that this limited the disorder to children and ignored the developmental nature of learning disabilities. Their position was that learning disabilities must be viewed as a problem "...of early childhood and as continuing into adulthood" (p. 107).

The third issue questioned by the committee was the etiology of learning disabilities. They maintained that the definition does not address this issue clearly and that the disorders ~~identified~~ identified under the term learning disabilities are intrinsic to the individual resulting from central nervous dysfunction. The committee proposed that "...learning disabilities have their basis in

---

inherently altered processes of acquiring and using information" (NJLD, 1981, p. 107).

The last problem discussed by the committee concerned the exclusion clause. Misinterpretation of this clause would imply that learning disabilities does not occur in multihandicapped persons or in people coming from different cultural or linguistic backgrounds. They supported the notion that learning disabilities can occur in persons having other handicaps and that it is not the cause or result of such handicaps.

The NJCLD (1981) proposed the following definition of learning disabilities in response to their review of Public Law 94-142.

> Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to central nervous dysfunction. Even though a learning disability may occur concomitantly with other handicapping conditions (e.g., sensory

> impairment, mental retardation, social and emotional disturbance) or environmental influences (e.g., cultural differences, insufficient/inappropriate instruction, psychogenic factors), it is not the direct result of those conditions or influences. (National Joint Committee on Learning Disabilities, 1981, LD Journal, 1987)

Although this definition has greater focus it remains global and continues to prompt controversy. Warner & Bull (1986) believe that definitions of learning disabilities "...must be shown to guide educational interventions" (p. 139). These authors attribute the problems in the field of learning disabilities to definitions which "...do not tell us anything about what we ought to do with a student after he or she is identified" (Warner & Bull, 1986, p. 140). An assumption to be made is that the more specific the definition, the greater the possibilities for research in the area of educational practices. This prospect is encouraging as the diverse use of definitions as well as the heterogeneous nature of the population have limited the usefulness of research in the area of learning disabilities and has made discussions and generalizations of findings from one district to another very difficult (Keogh, 1982). Bryant (1982) proposes that since the nature of difficulties varies from child to child and the causes of their different difficulties vary as well, "researchers must split up the major group into justifiable subgroups" (p. 273). Further support for this premise is provided by Torgesen (1982), "The ideal solution to the problem of heterogenety in LD samples would be a systematic taxonomy of LD subtypes" (p. 114). A movement in this direction would yield relatively homogenous subgroups identifiable by their own operational definitions. According to Torgesen (1982), an advantage to studying subgroups would be the "...increased clinical utility of findings (Senf, 1974), more clearly defined samples aiding in replication and extension of results" (p. 115). Another benefit would be the development of remedial programs that would be directly responsive to the specific deficits of the children in the identified subgroup.

The Speller and The Spelling Process

> "Intellectual processes are at the heart of learning to spell" (Otto and Smith, 1980, p. 334).

Research has indicated the complex and multifaceted nature of spelling. As a result of this research, some educators have attempted to develop models to explain spelling behavior. These models fall into one of two orientations, behavioral or process. A discussion of some of the process models is presented for the purpose of this study.

Information Processing Models of Spelling Behavior

Spelling is recognized as "...requiring more auditory and visual discrimination, memory, sequentialization, analysis and synthesis, and integration simultaneously than perhaps any other skill" (Johnson & Myklebust, 1964, p. 239) and is referred to by Hodges (1966) as one kind of information processing. He maintains that the brain stores programs or plans to react in certain ways to certain situations. The plan of action stored in the memory is triggered by the presentation of a particular stimulus. Hodges (1966) believes a plan will be triggered more readily if it has been stored through multisensory experiences.

Personke and Yee (1966) also propose a theoretical model that explains spelling behavior in terms of information processing. They present a very comprehensive theory consisting of five phases:

1. initial input processing - determining the problem to be solved;
2. information processing prior to deciding what course of action to consider to take;
3. decision making - analyzing what information is available through chosen channels;
4. executing selected behavior - spelling a word;
5. feedback of information through internal or external sources (Wallace & Larsen, 1978, p. 370).

The creators of this model have identified five channels or processes that are associated with spelling behavior. These include:

1. Memory Channel - the word is written from memory and then looked at for accuracy.

2. Memory-Kinesthetic Bypass - the word is written correctly without any conscious thought.

3. Checking channel - prior to writing the word, an external input (dictionary, person,) is referred to.

4. Proofread Channel - the word is written; then checked through the use of an external input.

5. Proofread Rewrite Detour - the word is checked through an external input, and written correctly if incorrect.

Essentially, Personke and Yee (1966) view the spelling process as unfolding in the following fashion:

1. The students' "need" to spell a word.

2. The availability of two input mechanisms to choose from in order to spell the word correctly.

    i. Internal input
        - the student uses learned responses such as generalizing phonological rules, word attack skills and proofreading.

    ii. External input
        - the student uses this option when internal input is inadequate.
        - includes using dictionaries, books, and/or asking the advice of others.

Support for Personke and Yee's (1966) assumption, that all spelling behavior is initiated by the "need" to spell a word, is found in Graham and Miller's (1979) model of the spelling process. Their model, like Personke and Yee's (1966) maintains that the "Need to Spell" precedes all spelling behavior. From this point of initiation, Graham and Miller (1979) propose that the student either has immediate recall of the word from memory or they do not. In the latter case, the student has "...two main resources upon which to draw" (p. 3). The first is intrinsic strategies and includes the use of: 1) direct phonemic spelling or application of student's knowledge of phonemic letter associations and phonemic rules; 2) the generate-and-test process where the student writes a variety of possible spellings and tries to recognize the correct one and 3) morphemic information or the form of words. The second resource available is referred to as extrinsic strategies. These strategies involve the use of dictionaries, books and help from a teacher, friend, etc. This resource is desirable in the situation where intrinsic strategies proved to be inadequate or when the student has used an intrinsic strategy but refers to an extrinsic strategy to check the precision of the response.

Seymour & Porpodas (1980) describe a two channel processing model of spelling. Essentially, spelling knowledge is thought to involve two functionally distinct processing systems. There is "...a grapheme-phoneme translation channel which can transform regular spellings into syllabic speech codes and a lexical-semantic channel which is capable of recognizing individual words or morphemes and of translating the visual input into a semantic or phonological representation" (Seymour & Porpodas, 1980, p. 444). Spellers therefore utilize either a lexical or a nonlexical processing system to produce or to recognize words. Gerber & Hall (1987) challenge this two channel hypothesis by questioning the relationship between the two processing systems. Issues such as whether or not there is a hierarchical precedence for the processing systems or if they function in a compensatory manner need to be examined.

Farnham-Diggory and Nelson's (1984) two program model of spelling behavior incorporates the notion of lexical and nonlexical processing systems. The programs involved are labelled LOOK-UP and SEGMENTATION. Words that a speller perceives as difficult result in the use of the LOOK-UP program whereby the output of a sequence of graphemes is rapidly produced. For easier words, the SEGMENTATION program is selected. This program involves the coding of the phonemic string into segments which are held in Short Term Memory. Farnham-Diggory and Nelson (1984) view these programs as being developmental with the SEGMENTATION program being used by older more skilled spellers.

An assumption common to all of the models is that proficient spelling behavior requires the integration of many abilities and skills. Furthermore the use of strategies by students appears to be an integral factor in spelling behavior.

The Simultaneous and Successive Model

A model of information processing, developed by Das et al (1979) based on Luria's (1966a, 1966b, 1973) theory of simultaneous-successive synthesis and planning behavior, provides some insight into spelling behavior. Although this model was not developed to explain spelling behavior it does allude to the processes involved.

Das et al's (1979) model attempts to explain cognitive abilities in terms of underlying processes. The model ~~was~~ derived from Luria's (1966, 1973) notion of higher cognitive functions.

Luria (1966) developed a complex model of cognitive functioning as a result of his work with brain damaged patients. He proposed that all mental functioning was the interaction of two coding functions, simultaneous and successive processing and a planning component. Brailsford, Das and Snart (1981) provide a description of these elements.

a) Simultaneous processing involves the synthesis of various separate elements into groups, with spatial overtones such that all parts of the group are brought together as a whole. Perceiving spatial wholes may occur in both the visual and auditory realms. For example, simultaneous processing is occuring when we glance at a painting and survey it as a whole, integrating all of the spatial relationships, or when we listen to an orchestra and all of the rythms, pitches, and tones are integrated into a holistic music scheme or unit. Such a synthesis of relationships is necessary for more complex, academically-related tasks such as the comprehension of numerical and geometric concepts, and the understanding of the grammatical system of language.

b) Successive synthesis involves the integration of separate elements into a series, or groups which are related temporally rather than spatially. Luria describes such elements as being integrated in a chain, with each link activating the next link in a continuous, but serial pattern. Successive processing is reflected in activities such as producting a series of written letters, memorizing a list of items, and producing or interpreting narrative speech.

c) Planning ability involves the generation and execution of programs, and the use of foresight and flexibility. This is apparent, for example, when a child demonstrates strategic intent within a task such as the planning and organizing of a written composition. (p. 8)

Simultaneous and successive coding and the planning component are thought to function in an interrelated manner (Luria, 1966; Das, 1979). Depending upon the specific task demands and the way of processing an individual prefers, either of the coding processes or the planning component may be utilized. These functions are believed to be involved in processes of memory, perception and abstract thinking. All incoming environmental information is viewed as being either simultaneous or successive in nature and the response to stimulation may also involve simultaneous or successive coding as well as the planning component. "...both simultaneous and successive coding are jointly implicated in every processing activity. The intent to use these processing strategies is a component of the planning function of the brain" (Brailsford, Das & Snart, 1981, p. 9).

The theoretical model proposed by Das et al (1979) conceives simultaneous and successive synthesis to be processes "by which the learner codes, organizes, stores, and utilizes information" (Brailsford, Das & Snart, 1981, p. 9). The planning strategies and the simultaneous-successive coding processes are believed to be available to every individual "for use in learning, depending on the individual's own processing abilities and preferences and also on the particular task demands" (Brailsford, Das & Snart, 1981, p. 9). Academic tasks vary in their requirements for planning and coding processes. For example "...the sequential segmenting and association of sound-symbol relationships required in initial spelling rely largely on successive processes" (Brailsford, Das & Snart, 1981, p. 11). Accepting this premise, successful spelling would then be associated with the students' proficient use of successive processing strategies.

Implications of the Simultaneous-Successive Model for Learning Disabled

The National Joint Council for Learning Disablities (NJCLD) (1981) statement that "...learning disabilities have their basis in inherently altered processes of acquiring and using information" (p. 107), reflects the finding that "disabled learners appear to experience coding problems and difficulties in utilizing appropriate coding processes necessary for particular school task requirements" (Brailsford, Das & Snart, 1981, p. 10).

Leong (1974) found reading disabled students who were two years behind in reading to be inferior to average readers in both simultaneous and successive processing. In a study by Das, Snart & Mulcahy (1982), the performance of mildly reading disabled students on successive processing tasks was found to be poorer than that of average readers. Torgensen (1978) also found this to be the case. As a result of these findings Das (1984) addresses the following significant question: "Do reading-disabled children lack the capacity for successive processing, or do they have the capacity but for some reason choose not to use it in reading?" (p. 40) Based upon the reasearch conducted, Das (1984) suggests that the problem is not the lack of ability but rather poor utilization of strategies for coding information. Essentially, children must be taught strategies to use skills such as successive coding (Das, 1984).

In response to this premise a remedial program was developed by Brailsford, Das and Snart (1981). Their "...remedial program emphasized the task appropriate use of simultaneous and successive coding processes. The intention was to strengthen cognitive processes underlying academic tasks and concurrently seek improvement in school performance" (Brailsford, Das & Snart, 19 , p. 16). The program utilized tasks that had been designed within the conceptual framework of the simultaneous-successive information processing model. Each task required either simultaneous or successive processing for successful completion. They were global in nature and did not look like school-related materials. Positive results were obtained when the training program was implemented with learning disabled students (Brailsford, 1981). Improved comprehension has been associated with simultaneous and successive training (Krywaniuk & Das, 1976; Kaufman, 1978; Brailsford, 1981), however, there has not been any research that has focused on the possible relationship of simultaneous and successive training to spelling performance.

Das and Conway (1986) have created a training program called Coding, Attention and Planning (CAP) which purports to train simultaneous and successive processing strategies. Similar to the tasks in Brailsford, Das and Snart's (1981) program, these tasks require either simultaneous or successive processing or both. The effectiveness of this program cannot be addressed as the CAP training program is currently in a pilot stage.

Both remedial programs represented alternate approaches for working with learning disabled students. It is apparent however that more research is required to explore the potential effect of these programs on other content specific curriculum areas such as spelling.

Spelling Difficulties of the Learning Disabled

Of the many difficulties experienced by learning disabled students, spelling seems to represent the greatest hurdle (Carpenter & Miller, 1982; Poplin et al, 1980).

Recently, spelling has come to be viewed as developmental (Gentry 1984; Bookman 1984). Gentry (1984) reports that "developmental spellings are spelling patterns resulting from different strategies that children use at various stages of cognitive development" (p. 13). As the child's knowledge of English orthography changes, the type of error changes. There is a general concensus among researchers that there are basically five developmental stages of spelling. The stages may bear a different label, however, the intent of each stage is the same. Spelling ability is thought to progress according to the following stages.

1. Precommunicative spelling. Spellers randomly string together letters without regard to letter-sound correspondence.

2. Semiphonetic spelling. Letters represent sounds but only some of the sounds are represented.

3. Phonetic spelling. Words are spelled like they sound. The speller represents all of the phonemes in a word though spellings may be unconventional.

4. Transitional spelling. A visual memory of spelling patterns is apparent. Spellings exhibit conventions of English orthography; vowels in every syllable, e-marker and vowel diagraph patterns, correctly spelling inflectional endings, and frequent English letter sequences.

5. Correct spelling. The word is spelled correctly (Gentry, 1984, p. 16).

Current studies conducted with learning disabled subjects suggest that their spelling abilities follow a normal pattern of development but at a delayed rate. Bookman (1984) compared the spelling errors of thirty-two learning disabled college students with regular grade five students who represented spelling-age controls. Within their study, errors such as nonphonetic or sequencing/orientation confusions were examined to determine if they occurred more frequently among learning disabled students or the normal grade five achievers. The results suggest that, in learning to spell, learning disabled students followed the same sequence as the normal achieving grade five students. Furthermore, the learning disabled did not make any more sequencing/orientation errors than the normal achievers did.

Carpenter (1983) reports similar findings in his study which analyzed and compared the error patterns of disabled readers; able readers of the same age, and young able readers. He found that the disabled readers spelled and used error patterns like younger able readers.

Frith (1980) in her study comparing the individual and develpomental spelling differences of students who were good readers and good spellers; good readers and poor spellers, and poor readers and poor spellers, found that dyslexics or poor readers and poor spellers, experienced problems at an early stage of the spelling process. Their errors were inconsistent and not very phonetic.

Studies conducted by Baron (1980) and Bryant and Bradley (1980), suggest that poor readers tend to rely solely on a phonological strategy in spelling or stage 3. They fail to move beyond this level to use visual strategies at stage 4. Bryant and Bradley (1980), propose that children experience difficulty in cognitive tasks such as spelling, "...not because they lack the aptitude but rather because they don't know exactly when it needs to be applied." (p. 370)

Seymour and Porpodas (1980) conceptualized the spelling difficulties of learning disabled students in terms of a two channel hypothesis. They described a grapheme phoneme channel which they defined as transforming regular spellings into syllabic speech codes and a lexical semantic channel which is thought to recognize individual words or morphemes and translate this visual input into a semantic or phonological representation. They conducted a series of studies to investigate the interpretation of the two channel model for dyslexic persons. The experiments involved four dyslexic children, two dyslexic adults, eight capable readers aged seven years and eight capable readers aged nine years. The seven year olds represented the dyslexic reading age controls and the nine year olds represented the dyslexics chronological age controls.

Three experiments were conducted to acquire information about the non-lexical channel. The first experiment explored the visual processes occurring at the level of the graphemic register. The results of the experiment demonstrated that the dyslexics performed very much like their reading age controls. A second experiment examined the rate and accuracy of the grapheme-phoneme translation channel. The findings indicated that the dyslexics error rate was similar to their reading age controls however their reactions were significantly slower. The adult dyslexics also demonstrated a slowing of response. The third experiment was designed to determine the efficiency of the non-lexical phoneme-grapheme translation channel. The results demonstrated that the dyslexics' frequency of errors were similar to that of the younger reading age controls when work length was increased. The authors concluded as a result of these experiments that the dyslexic subjects were deficient in non-lexical spelling knowledge and that the grapheme-phoneme translation channel though operational was impaired in functioning speed.

Seymour and Porpodas' (1980) next series of experiments focussed on the lexical-semantic channel. From these studies the authors concluded that although the lexical channel for the dyslexics was operational, impairment was observed in time required for translation and in their range of vocabulary. The findings of Seymour and Porpodas' (1980) investigations support the notion that learning disabled students compare to younger students in their spelling ability.

Gerber and Hall (1987) have identified three general characteristics of the spelling of learning disabled students.

Like younger spellers, LD pupils:

> 1. Have difficulty maintaining dictated words in STM long enough to encode the complete phonemic string;
>
> 2. Do not necessarily identify the same conventional phonemic boundaries in words as do their more skilled peers; and
>
> 3. "Invent" simple, economic sound-to-alphabet correspondence rules, often ad hoc, to govern phonographic translation processes.
>
> (Gerber & Hall, 1980, p. 39)

Overall, the literature appears to view the difficulties the learning disabled experience in spelling in terms of developmental stages. The learning disabled tend to function at stage two (Semiphonetic spelling) and stage three (Phonetic spelling) of the spelling process.

The assumption that the learning disabled do not use the strategies associated with the higher stages of the spelling process has positive implications for spelling remediation. For example, remediation could focus on training and/or teaching strategies necessary for success at the different stages of the spelling process.

Remediation Methods Used With Learning Disabled

> Spelling! What teacher of the learning disabled hasn't sweated over innumerable written papers where the same words were written several different ways - on the same page! We've given our students spelling lists to memorize, tested them, had them rewrite the misspelled words - and often been puzzled because they haven't made the improvements we expected.
>
> (Ganschow, 1983, p. 185)

Spelling methods have come along way since the memorize-test-practice method described in the above quotation. Though often still puzzled, educators now have numerous approaches available to them for spelling remediation.

The approaches to remediation of spelling with learning disabled students are as diverse as the students who constitute the category. Some of the more traditional methods used include: Multisensory methods in spelling; The Fernald method (Fernald, 1943); Study-test method; Test-study-test method; Spelling Words on the filmstrip projector; etc.

One of the current trends in spelling remediation involves the use of an imitation/modelling procedure. Kauffman et al (1978), demonstrated the effectiveness of imitating the child's spelling error before showing the correct model. They maintained that it helped the child focus attention on how the incorrect responses differed from the correct one. Gerber (1984) used this procedure with an eleven year old learning disabled girl. The procedure involved the student writing a target word. When the word was spelled correctly the student was given confirmation, if incorrect the student was provided with verbal cues and then required to copy the correct spelling. The results of this study indicated that the imitation/modelling procedure was successful in improving the spelling performance of the student involved. However, due to the nature of the study (only one subject) the implications of their findings are limited. Nulman and Gerber (1984) also carried out a study using the same procedure with a learning disabled student. Their findings substantiate Gerber's (1984), however, because the design they used is so weak, their results can only serve to promote interest in continuing research in this area.

Reliable and valid support for the use of an imitation/modelling procedure, however, is found in a complex study conducted by Gettinger (1985). She used an alternating treatments design to compare the effect of four remedial procedures or conditions on nine poor spellers. All of the procedures involved imitation and modelling. Two of the procedures combined imitation and modelling with visual and verbal cues. One was teacher-directed while the other was student-directed. The remaining two conditions utilized the imitation and modelling procedures without cues. Again, one was teacher-directed while the other was student-directed. The results indicated that all of the conditions produced improved spelling performance, however, the student-directed condition incorporating visual and verbal cues had the greatest effect. Essentially their results indicated, student-directed conditions, with and without cues were superior to teacher-directed conditions.

Other variables being considered in spelling remediation include unit size, distributed practice, and training for transfer. It has been found that these learning principles are relevant for teaching spelling to learning disabled students (Gettinger et al, 1982; Gettinger, 1984). Bryant et al (1981) demonstrated that the spelling performance of learning disabled students was related to the number of spelling words presented in a lesson. When the learning disabled students were given three spelling words to learn on each of three consecutive days, sixty-two percent of the students achieved 100 percent mastery. When the learning disabled students were given one and two additional words to learn each day, the percentage of students achieving mastery dropped to 30 and 17 percent, respectively.

Wong (1986) utilized teaching structural word analysis and a self-questioning monitoring strategy to investigate spelling improvement. Eight sixth graders with spelling deficits participated in the study. The findings demonstrated that the students benefited from a remedial program that encompassed both structural analysis of words as well as a monitoring system.

Englert, Hiebert and Stewart (1985) implemented a study that instructed students in using spelling patterns from known words to spell new words. The subjects used in this study were comprised of nine learning disabled and two educable mentally retarded in both the experimental and control groups. The mean reading level for both groups was 2.2. The results indicated that the analogy strategy had a positive effect on the ability of students to spell noninstructed words. The experimental group demonstrated greater gains in spelling transfer words.

Although the remedial procedures discussed in this review present encouraging results, they are not conclusive. It would seem that "many novel, individualized approaches to teaching spelling to LD students have been tried; however, no technique, method or curriculum has proved itself to be unequivocally "best" (Gerber & Lydiatt, 1984, p. 9).

CHAPTER III

RATIONALE, HYPOTHESES, AND DEFINITIONS

Rationale for Study

This literature review has indicated that learning disabled students demonstrate deficiencies in the strategies necessary for successful spelling. As the spelling process involves the use of strategies, inadequacy in this area represents a significant problem and warrants continued research. It was therefore the intent of this study to implement a spelling program that focused specifically on strategy training with reading disabled students in grades three, four and five whose spelling deficits were not attributed to factors of intelligence, sensory impairments or documented neurological impairments. The theory that provided the framework for this investigation was Das et al's (1979) simultaneous/successive model of information processing.

Knowing that "spelling ability and reading ability are highly and positively correlated" (Otto & Smith, 1980, p. 352), the assumption that reading ability is linked to simultaneous and successive processing holds certain implications for the remediation of spelling abilty. For example, if positive gains have been obtained in reading comprehension as a result of simultaneous and successive strategy training, the potential for spelling to be affected similarily exists.

The intervention procedure developed for this study attempted to incorporate spelling remediation with the "Coding Attention and Planning training program created by Das and Conway (1986) which purports to train simultaneous and successive processing strategies. For the purposes of this study, emphasis was placed on the training of successive processing strategies as "initial spelling relies largely on successive processes" (Brailsford, Das & Snart, 1981, p. 11). These processing strategies were trained in conjunction with a spelling program designed to reflect the principles underlying Das and Conway's (1986) program. The strategy training involved five tasks from Das and Conway's (1986) global training program and five spelling tasks. The five CAP tasks selected for use focused on successive processing strategies. The tasks used included: Task 10 - Bead Threading (Watch It); Task 11 - Serial Recall (Recall It); Task 13 - Syntax Task (Show It); Task 16 - Telephone (Dial It); Task 18 - Joining Shapes (Join It). The five spelling tasks were modeled after each of the CAP tasks.

Hypotheses

This study is concerned with two areas, process improvement and spelling improvement. Four hypotheses are proposed for the purposes of this study, three of which are related to process improvement and one to spelling improvement.

Hypotheses For Process Improvement

Hypothesis I: Greater improvement on the successive measures for the Expermintal Group than for the Control Group.

Due to maturation, familiarity with the pretest battery, and exposure to other classroom learning that may have involved successive processing both

Experimental and Control Groups may be expected to demonstrate post-test improvement. However it is anticipated that there will be greater improvement for the Experimental Group on the successive measures than for the Control Group due to the training of successive processing strategies during remediation.

Hypothesis 2: The Experimental Group's improvement on the simultaneous measures will not be greater than that of the Control Groups'.

Post-test improvement on the simultaneous measures may be expected for both groups due to maturation, pretest experience and incidental learning that may have occured. It is anticipated that the difference between the Experimental and Control Groups on the simultaneous measures will not be significant since neither group was exposed to specific training in this area.

Hpothesis 3: Greater improvement on the planning measures for the Experimental Group than for the Control Group.

Planning according to Das et al (1979) involves both simultaneous and successive processing. Both the Experimental and Control Groups may be expected to demonstrate improvement on the post-test battery due to possible exposure to learning in the classroom which may have focused on simultaneous and successive processing, to maturation and to having had prior experience with the pretest battery. It is expected, however, that there will be greater improvement for the Experimental Group since the successive processing training which included a strong component of planning was the focus of the remediation for the Experimental Group.

Hypothesis For Spelling Improvement

Hypothesis 4: Greater improvement on the spelling assessment for the Experimental Group than for the Control Group.

Both groups will be exposed to spelling remediation during the eight week intervention period and will be expected to show improvement on the spelling assessment. It is hypothesized that the Experimental Group will demonstrate greater improvement on the spelling assessment as a result of the strategy training that focused on successive processing. "As spelling requires the sequential ordering of letters, according to the information integration model developed by Das (cf. Das, Kirby & Jarman, 1979), successive measures should be related to spelling ability" (Varnhagen & Varnhagen, 1986, p. 5).

The Test of Written Spelling assesses the child's ability to spell "Predictable" words (words that conform to rules and generalizations) and "Unpredictable" words (words that do not conform to rules). When spelling Unpredictable words there is a greater demand for successive processing as the student must focus on the sequence of the letters in the word. Spelling Predictable words allows the student to rely more on generalizations from previous learning.

It is therefore expected that the Experimental Group will demonstrate even greater improvement than the Control Group on the Unpredictable subtest as a result of the focus placed on successive processing during the intervention period.

Definitions

The following definitions will be used within the context of this study.

Reading Disabled: In accordance with Torgensen's (1982) reference to subgroups, a subgroup of reading disabled children with spelling deficits were identified for the purposes of this study.

1. an IQ score of 85 or above as measured by the WISC-R;
2. English as a first language;
3. reading two years or more below grade level on Burns and Roe Silent Reading Inventory (see Appendix A);
4. Spelling two years or more below grade level on the Schonell Spelling Inventory, Form A.

Spelling: "the ability to recognize, recall, reproduce or obtain orally or in written form, the correct sequence of letters in words" (Graham & Miller, 1979, p. 3).

CAP: Coding Attention and Planning training program developed by Das and Conway (1986).

CHAPTER IV

METHOD AND PROCEDURES

A pretest-posttest control group design was employed for the purposes of this study. The study involved three phases. The first phase involved the selection of the sample of subjects and the administration of the pre-test battery. In the second phase, the remediation program for the Experimental Group was implemented. The final phase included the administration of the posttest battery as well as the analysis of the data to determine the extent to which the intervention program was effective.

Selection of Subjects

Twenty subjects were selected for the purposes of this study. The students chosen demonstrated difficulties in spelling accurately, attended special education classes and had IQ's above 85. These students were further screened to ensure English was their native language and that they did not have vision or hearing impairments. The students were selected from J.A. Fife Elementary School where two special education classes for learning disabled students are housed. One class of 10 represented the experimental group while the other class represented the control group. The student's ages ranged from 8 to 12, with a mean of 10.6 for the experimental group and a mean of 10.8 for the control group. The full scale IQ's as assessed by the WISC-R, of all the students ranged from 85 to 111 with a mean of 93.2 (SD 8.3) for the experimental group and a mean of 92.5 (SD 9.0) for the control group. The grade scores on the Schonell Spelling Inventory for all the students ranged from 1.0 to 3.8 with a mean of 2.3 (SD .8052) for the experimental group and a mean of 2.5 (SD .6693) for the control group. To obtain measures of the equivalence in age, I.Q. and grade equivalent scores on the spelling inventory, T-tests for independent samples were calculated. Table 1 shows that no significant statistical differences were found to exist between the groups.

The Pretest Battery

The pretest battery was administered during the month of January, 1987 to the students individually

5

Table 1

T-Tests (Independent Samples): Differences Between the Means of the Experimental and Control Group on Age, I.Q., and Grade Equivalent Score on the Schonell Spelling Test (Form A)

				Pooled Variance Estimate		
Variables	Number of Cases	Mean	Standard Deviation	T Value	Degrees of Freedom	2-Tail Prob.
IQ						
Experimental Group	10	93.2000	8.324	0.18	18	0.859
Control Group	10	92.5000	9.058			
Age						
Experimental Group	10	128.1000	15.730	0.29	18	0.733
Control Group	10	129.7000	7.243			
Schonell Spelling						
Experimental Group	10	2.3	.8052	0.60	18	2.101 (t critical)
Control Group	10	2.5	.6693			

and in group settings. The testing was conducted in quiet settings (ie. nurses room, counsellor's office). The administration and scoring of all of the tests was completed by the writer. The tests were presented in the following order:

1. Spelling Assessment

The Test of Written Spelling (TWS-2) was administered to the students in a group setting. This test is divided into two subtests to accommodate the theory that a child learns to spell in two ways. First, the child learns to apply rules and generalizations and second, the child must rely on memorization skills. The former is instrumental when learning words that conform to the rules while the latter is necessary for learning to spell words that do not. The students in this study were given both of the TWS-2 subtests.

The TWS-2 was standardized on 3,805 children across 15 states. The breakdown of the subjects indicates that the sample was nationally representative. Raw scores can be converted to percentiles and standard scores for each subtest and for the total scores. Internal-consistency estimates of reliability are provided for each age interval. All of the coefficients were above .92 and therefore, acceptable. The test-retest reliability coefficients that were provided for grades 1 to 8 were all above .91, demonstrating that the results of the TWS-2 are reliable over time. In terms of validity, the TWS-2 measures the spelling of predictable words and unpredicatble words. Construct validity was established by demonstrating the intercorrelation of the three TWS-2 scores with each other and with age. The content validity was established during the construction of the test. The fifty words that comprise each of the subtests were carefully selected to ensure that they were actually taught in schools. The words up to grade 8 appear in 5 commonly used American basal spelling series and the words above grade 8 appear on word frequency lists. The criterion-related validity of the TWS-2 was established by correlating it with four other tests thought to measure spelling ability. The coefficients were all significant.

The administration of the TWS-2 involved the examiner first saying the word in isolation, then using the word in a sentence and finally saying the word again in isolation. The subjects were required to write the words dictated. Scoring the TWS-2 involved considerations of basal and ceiling scores.

2. Cognitive Assessment System - Planning Measures

The CAS purports to assess a) attention, b) coding of information, and c) planning strategies. For the purposes of this study only the planning measures were used. These included; Planned Connections, Crack the Code and Visual Search. The CAS was administered to the subjects individually. Descriptions of these subtests are provided below.

Subtest - Visual Search

Visual Search is comprised of twenty items subgrouped under Automatic Search and Controlled Search. Items 13 to 16 labelled Number among Picture, items 17 to 20 labelled Picture among Number, complete the Automatic Search category. The

Controlled Search category includes items 1 through 12. These items are grouped in the following manner: Picture Among Picture, items 1 to 4; Number Among Picture, items 5 to 18; Letter Among Letter, items 9 to 12.

Task Description:

"The child's task in this planning subtest is to find an object, number or letter located in a box in the center (called the Target) of the group of objects (called the Field). The examiner presents the item (on one page) which contains 2 searches, and times the child's search from the moment the page is exposed (or turned) until the child points to the second object on that page. That is, the child's score is the time it takes to find the two Targets which comprise the item, from the moment the page is exposed until the time the child is finished with the item (both Targets found within the Field). Administer all items in all cases." (Das, Naglieri, 1987, p. 6 form 2)

Subtest - Crack the Code

Task Description:

"In this planning subtest the student's task is to determine what the correct sequence of colored chips is when given a limited amount of information. The subject is given two or three trials to figure out the one correct order of chips for each of the 7 items. The subtest is organized into 7 items with 2 or 3 trials per item and a 3 minute limit per item. Do NOT administer to grade K-2." (Das, Naglieri, 1987, p. 34 form 1)

Subtest - Planned Connections

The Planned Connections subtest is subdivided into two sections, items 7 plus 8 and items 9 plus 10.

Task Description:

"The child's task in this subtest is to connect, using a regular pencil, a series of numbered boxes in correct numerical sequence as quickly as possible. There are two kinds of items in this subtest; those that include numbers only, and those that include numbers and letters. The latter items involve connecting the boxes using numbers and letters (1-A-2-B-3-C etc.). The score for all items is the time it takes to complete each page." (Das, Naglieri, 1987, p. 4 form 1.

Considerations of validity and reliability of the CAS cannot be discussed at this time as the authors are currently involved in establishing this data base.

3. The Kaufman Assessment Battery For Children

The K-ABC was administered to the subjects on an individual basis. This assessment provides data in four global areas of functioning; Achievement, Simultaneous Processing, Sequential Processing and Mental Processing Composite (Sequential plus Simultaneous). Only the mental processing subtests were employed for the purposes of this investigation. These included; Hand Movements, Number Recall, Word Order, Gestalt Closure, Triangles, Matrix Analogies, Spatial Memory and Photo

Series. These subtests have been organized under their appropriate scale. Descriptions of these tests are provided below.

Sequential Procesing Scale

Hand Movements (ages 2-6 through 12-5)
Performing a series of hand movements in the same sequence as the examiner performed them.

Number Recall (ages 2-6 through 12-5)
Repeating a series of digits in the same sequence as the examiner said them.

Word Order (ages 4-0 through 12-5)
Touching a series of silhouettes of common objects in the same sequence as the examiner said the names of the objects. (More difficult items include an interference task between the stimulus and response).

Simultaneous Processing Scale

Gestalt Closure (ages 2-6 through 12-5)

Naming an object or scene pictured in a partially completed "inkblot" drawing.

Triangles (ages 4-0 through 12-5)
Assembling several identical triangles into an abstract pattern to match a model.

Matrix Analogies (ages 5-0 through 12-5)
Selecting the meaningful picture or abstract design which best completes a visual analogy.

Spatial Memory (ages 5-0 through 12-5)
Recalling the placement of pictures on a page that was exposed briefly.

Photo Series (ages 6-0 through 12-5)
Placing photographs of an event in chronological order.

(Kaufman, Kaufman, 1983, p. 3)

The K-ABC was standardized on more than 4,100 administrations. Split-half reliability, of the K-ABC was established with the use of the

Rasch-Wright model. The obtained coefficients showed very good internal consistency. The mean value for 12 of the 16 subtests was .80 and above. The test-retest data obtained on the K-ABC indicates that a practice effect exists especially for the Simultaneous Processing Scale and the Mental Processing composite. An overall practice effect of 5 points was noted for each age group on the Mental Processing Scale. The authors advise caution if the child is tested for the second time within a few weeks or months as the effect of practice is a factor.

Support for the construct validity of the K-ABC mental processing subtests was established through a correlational study between K-ABC and Factor scores on the Das-Kirby-Jarman Successive-Simultaneous battery. The Sequential Processing subtests of the K-ABC were found to correlate highly with the Das-Kirby-Jarman Successive factor and the K-ABC Simultaneous Processing subtests were found to correlate highly with the Das-Kirby-Jarman Simultaneous factor. The predictive validity of the K-ABC Mental Processing subtests was established through six studies that were conducted with school age children. The findings indicated that for four out of six samples, Sequential and Simultaneous Processing were equally effective as predictors of achievement. Further, there was a tendency for Simultaneous Processing to correlate more highly with mathematics than Sequential Processing and for Sequential processng to correlate more highly with spelling than Simultaneous Processing. The administration of the K-ABC subtests, is accommodated by the use of an easel format, the record forms and scoring instructions.

4. Instructional Word List

Students were pretested with a total of 150 words from grades 1-5 to establish a battery of 39 words that could be utilized for the purposes of this study. The words were selected from the lists constructed by Thomas (1974). These lists were developed after extensive evaluation had been carried out on compositions at each grade level. Words most frequently written and misspelled by Alberta school children were determined as a result of the project.

The Intervention Step

The implementation of the intervention program for the experimental group began in their classroom on February 2 and continued until each student had received twenty hours of remediation. To accommodate the accumulation of the required hours, all of the students were exposed to thirty-five training sessions. The control group participated in their existing remedial spelling program established in their classroom. Their program involved the use of the "I Can Spell" series.

Posttest Battery

The posttest battery consisted of the same tests administered in the pre-test battery. Both control and experimental groups were administered the posttest battery by the writer within the same period of time under the same conditions. The post testing was completed for all students by April 17th.

The Intervention Program

Preparation and Organization of Material

Materials for each of the CAP and spelling tasks were gathered, prepared and organized by the writer with assistance of a classroom aid. These tasks had not been developed by anyone prior to this time. Two complete sets of materials were prepared for each of the CAP and spelling tasks. To facilitate organization, these materials were kept in separate boxes and labelled accordingly. The materials created for each of the tasks are described below.

CAP Tasks

Task 10 Bead Threading (Watch It)

Resources/materials required - large and small yellow, red, blue, and green beads

- 2 threading frames or similar apparatuses

- cards displaying beads in different sequences of colors and sizes on a bead pole

- bead sequences to follow at each level

- forms for recording the responses

Task 11 Serial Recall (Recall It)

Resources/materials required - pictures on small 4 cm. by 4 cm. cards (one set for student, one set for teacher). Pictures were selected from phonic booklets

- specified sequences for the pictures at each level

- forms for recording the responses

- labelled envelopes to keep the picture sequences in order at each level

Task 13 Syntax Task (Show It)

Resources/materials required - story sequences for each of the levels

- pictures for each of the story sequences on cards 4 cm. by 4 cm (one set for student, one set for teacher). Pictures were selected from phonic booklets

- forms for recording the responses

- labelled envelopes to keep the story sequences in order at each level

Task 16 (Telephone (Dial It)

Resources/materials required
- a dial telephone
- number sequences to read at each of the levels
- forms for recording the responses

Task 18 Joining Shapes (Join It)

Resources/materials required
- laminated pages of shape patterns
- teacher directions to follow for directing learners as to how the shapes are to be joined

- forms for recording the students' performance

- various colors of felt pens

Spelling Tasks

Word Bank: 39 spelling words

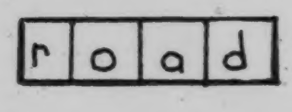
Resources/materials required - 10 copies of the complete word bank printed on file cards. Each card numbered according to a set order.

- 10 file card boxes with a file divider inside (one for each student).

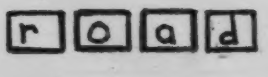
The spelling tasks involved the words from the students' word bank. Each student was provided with a card box containing all of the words from the word bank written on file cards. A divider was included in each box. The words had been assigned a corresponding number for identification.

Spelling Task to Follow CAP Task 10

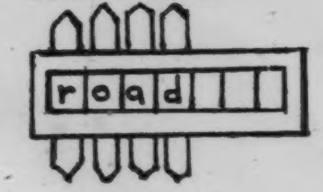
Resources/materials required - the 39 spelling words printed on 21 cm. by 6 cm. cards numbered according to a set order



- separate letters for each of the spelling words printed on card strips



- window chart



- laminated strips for the windows ie.

- labelled envelopes to hold the individual letters for each of the spelling words.

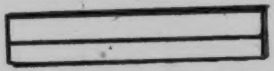
- forms for recording student responses.

Spelling Task to Follow CAP Task 11

Resources/materials required - the 39 spelling words printed on 21 cm. by 6 cm. cards numbered according to a set order

- separate letters for each of the spelling words printed on card strips (one set for student, 1 set for teacher)

- card holder for letter strips



- labelled envelopes to hold the individual letterstrips for each of the spelling words

- forms for recording student responses

Spelling Task to Follow CAP Task 13

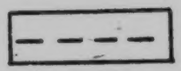
Resources/materials required - tape recorder

- head phones

- a tape with specific instructions for the students to follow

- letters for each of the spelling words printed on small card strips

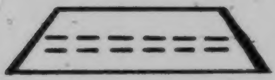
- a laminated card for each of the spelling words with segmented lines corresponding to the number of letters in each word



- sets of 3 strips of paper numbered 1-2-3 stapled into booklets.

- blue booklets for each of the spelling words. The booklets are comprised of strips of paper with segmented lines organized in a chaining fashion so that page one has one line for the first letter of the word and page two has two lines for the first and second letters of the word etc.

- pocket chart for letter strips



- small labelled envelopes for the letter cards for each word
- forms for recording student responses
- felt pens
- mail box

All of these materials except the pocket chart and tape recorder were created for each of the spelling words and then placed in separate brown envelopes and labelled with the numbers that corresponded with the spelling words.

Spelling Task To Follow CAP Task 16

Resources/materials required - language master

- head phones

- the recording of each of the spelling words on a language master card. The word is said on side 1 of the card followed by a sentence using the word. The word is spelled on side 2 of the card

- letter cards for each of the spelling words with additional letters included
- yellow strips of paper 15 cm. by 6 cm., number 1, 2 or 3
- small envelopes for the letter cards for each word
- form for recording student responses
- mail box

These materials, except for the language masters and headphones, were organized in brown envelopes for each of the spelling words. The envelopes were labelled with the numbers assigned to the spelling words.

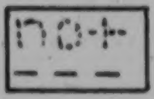
Spelling Task to Follow CAP Task 18

Resources/materials required

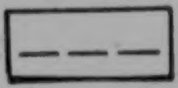
- tape recorder
- headphones
- tape with specific instructions for the student to follow
- letters for each of the speling words
- laminated card for each spelling word. Side 1 of the card presents the letters of the spelling word in a segmented manner and arranged in an uneven sequence. At the bottom of the card, spaces for the

letters in the spelling word are provided

ie.



Side 2 of the card has segmented lines corresponding to the number of letters in the spelling word



- booklets of yellow strips of paper numbered 1-2-3

- mail box

- form for recording the students' responses

These materials except for the tape recorder and head phones were kept in separate brown envelopes for each word. The envelopes were labelled with the numbers assigned to the spelling words.

Organization of the Classroom

The remediation sessions took place in the students' classroom to accommodate the training. The stations were situated away from the instructional area of the classroom. To avoid unnecessary distractions, a divider was placed between the stations.

Organization and Scheduling of the Remediation Program

A schedule was prepared for each day of the intervention phase, outlining which tasks would be used for training, the order in which students would receive remediation, the order the tasks would be presented to each student and which words each student would be working with that day. These schedules allowed for the daily organization and preparation of materials.

To ensure all CAP tasks were given equal training, a schedule for implementing the tasks was set prior to beginning the remedial program.

The remediation sessions in the intervention program involved training in two stations. Each station trained a different CAP task. A student would receive five minutes of training on a CAP task and then ten minutes on the associated spelling task at each station. Following the training at both stations a cummulative spelling test was administered bringing the total time of the session to thirty-five minutes. The stations were operated by the classroom teacher and the classroom aid.

The remedial training was scheduled for the mornings. The students were on individual programs and worked independently on assignments until they were called for their remedial session. After the remedial session, students returned to their individual assignments. Each day the students were provided with schedules for their morning assignments. The instructional component of the students' school day was scheduled for the afternoons.

Record Keeping

The students' daily performance on the CAP and spelling training was recorded. Specific record forms were used for each activity. The information obtained from the CAP record forms provided the basis for establishing a starting point for training the student the next time the task was used. The spelling record forms provided the teacher with information on how well the students had performed at each station. They also provided diagnostic information in terms of how the students were misspelling the words. This allowed the teacher to point out trouble spots for the students to focus on. The cummulative spelling tests illustrated the daily progress of each student as well as indicated to the student which words had been mastered and which had not. The scores of the cummulative tests were recorded for each student.

Description and Instructions for the Global Tasks

The CAP training followed the specific guidelines provided in the instruction manual. The

CAP training tasks were sub-divided into levels. The same sequence of symbols were used in each CAP task to maintain consistency between tasks. The symbols used were: □ , △ , ○ , ⬡ , ◊ , ♡ , + . The levels progressed from simple to more difficult. All of the students were exposed to the first level □ in each CAP task and moved on from there. A description and the instructions for each of the five CAP tasks follows.

CAP Task 10 Bead Threading

Strategy: Successive

Objective: To thread a bead pattern by recall following either teacher demonstration or card study

Instructions

1. Using the bead pole , the teacher drops beads in a predetermined order, ensuring that the beads can be seen by the learner.

2. Learner copies the pattern using his/her own frame.

3. Check correctness of sequence by lifting the cover off the frame.

4. Student should repeat the task if incorrect (provide more cues).

5. Teacher records response (1 for correct, 0 for incorrect)

or

1. Teacher holds up a card with a picture of beads on a bead pole for the student to study.

2. Card is removed.

3. The student then attempts to duplicate the pattern observed.

4. Student then checks the card for accuracy. Teacher records the response (1 for correct, 0 for incorrect).

5. Student should repeat the task if incorrect. (discussusion of clues and strategies should precede next attempt).

CAP Task 11 Serial Recall

Strategy: Mixed task - can be attempted either simultaneously or successively.

Objective: To recall a series of picture cards of increasing length.

Instructions

1. The teacher presents a sequence of picture cards.

2. Following the removal of the cards, the learner is asked to recall the sequence by laying the same cards on the table. Teacher records the response (1 for correct, 0 for incorrect).

* Repeat if incorrect (allow for more exposure time).

* Discuss students' correct response. ie. How did you remember the correct order? etc.

or

1. The teacher presents a sequence of picture cards one at a time.

2. The teacher then turns the picture cards over one at a time so that they are no longer visible.

3. The student then arranges his own set of picture cards in the same order.

4. The student then checks his cards by turning the model cards over one at a time. Teacher records the response (1 for correct, 0 for incorrect).

5. Repeat steps if student is incorrect. Discussion of strategies should precede next attempt.

CAP Task 13 Syntax Task

Strategy: Successive

Objective: To point to a series of pictures in the sequence of a story read by the teacher.

Instructions

1. The teacher places pictures on the table then reads a story.

2. The learner then points to the pictures in the story sequence. Teacher records the response (1 for correct, 0 for incorrect).

3. If the response is incorrect, remove the pictures and read the story again. Then give the pictures to the student to arrange in the proper order.

4. If still incorrect, repeat 1 and 2 and discuss possible strategies.

or

1. The teacher reads a story.

2. The teacher then gives the learner pictures to arrange in the order heard in the story.

Response is recorded (1 for correct, 0 for incorrect).

3. If response is incorrect, discuss how the order could be remembered and repeat the steps.

CAP Task 16 Telephone

Strategy: Successive

Objective: To dial from memory telephone numbers of increasing length.

Instructions

1. The teacher reads a digit number sequence (allow 1 second delay between each digit).

2. Learner then dials this sequence on a telephone. Teacher records response (1 for correct, 0 for incorrect).

3. Repeat sequence if incorrect - discuss ways of remembering.

4. Discuss student's correct response.

CAP Task 18 Joining Shapes

Strategy: Successive

Objective: To join a series of shapes according to a set of instructions.

Instructions

1. The learner is given a laminated card with shape patterns on it.

2. The teacher directs the learner as to how the shapes are to be joined. Teacher records the response (1 for correct, 0 for incorrect).

3. The students response is discussed. Repeat task if incorrect.

Description and Instructions for the Spelling Tasks

At the onset of the program, all of the spelling words were placed in front of a divider in the students' card boxes. As the words were mastered, they were placed behind the divider. Two spelling words were practiced each day. Both words were used with each of the spelling tasks. A test on the words practiced during a session and on words from previous lessons (words behind the divider in their card box) was administered daily. The words misspelled on the test were placed back in front of the divider for more practice the next day.

The spelling tasks designed to reflect the CAP tasks are described below.

Spelling Task to Follow CAP Task 10

Instructions

Steps to Follow:

1. Teacher will present a card with letters arranged on it and say "This word is ________ ", and then turn the card over immediately saying "Use the letters in front of you to make this word" (student places letter cards in a card holder). Teacher records the response and asks the student to mix up the letters.

2. Teacher presents a window chart to the student. Each window has a strip of paper with a letter

on it. The teacher says "Watch Carefully". The teacher then pulls the strips through the windows one at a time, saying the letter name. The letter is exposed for no longer than 5 seconds. Student is then asked to arrange the letters in front of him, in the card holder as he remembers seeing them. Teacher records the response. Student checks his response by exposing the letters in the windows. Each letter is left exposed to allow student to check. Student corrects errors as they are discovered.

3. Teacher takes the chart from the child. Holding up the chart for the child to see the letters are still exposed. Teacher then says the name of each letter and then pulls the letter out of sight. Teacher says the whole word after the last letter has been named and pulled out of sight. The student is then asked to place the letter cards in the holder in the correct order. Teacher records the response. The student is then given the window chart to check his response. Student checks his response by

exposing the letters in the windows. Each letter is left exposed to allow student to check. Student corrects errors as they are discovered.

4. Repeat step 3.

5. Repeat step 1.

Spelling Task to Follow CAP Task 11

Steps to Follow;

1. Teacher presents a model, __________ saying this word is roads. Then turns it over. (Total exposure time should not exceed 5 seconds). Teacher then asks the student to use the letters in front of him to make the word. (Student places letter cards in a card holder). Teacher records the response and asks the student to mix the letters up.

2. Teacher then places model letter cards down one at a time to spell the target word.

3. The student is told to study carefully where each letter is. Then the teacher turns the letter cards over one at a time so they are no longer visible.

4. The student is then asked to arrange his letter cards in the same order as the model cards.

5. Student then turns the model cards over one at a time to compare.

6. Student corrects errors if any.

7. Steps (2)-(6) are repeated two more times.

8. Step (1) is repeated.

Spelling Task to Follow CAP Task 13

The student is given a brown envelope containing:

- a tape
- letters in a small white envelope
- 1 laminated card

- 3 strips of paper numbered 1-2-3 stapled into a booklet
- a blue booklet

Student puts the tape on to listen to instructions.

Tape Instructions:

The word you will be practicing to spell is _______. Here is the word used in a sentence ________________. In front of you are 3 yellow strips of paper stapled together. Print the word _________ on the yellow sheet numbered (1) and place it in the mailbox in front of you. Turn the tape off to do this and turn it on when finished. Now take the materials out of the brown envelope with number ____ on it. Shut the tape off to do this. Please empty the letters out of the white envelope. Make a row with the letters. Shut the tape off and turn it on when finished. These letters make the word _________. The first letter in the word __________ is ___. Find the ____ and place it in the first pocket on the chart in front of you, etc. Now on the laminated card print the word __________ on the lines provided. Shut the tape off and turn it on when ready. Now, point to each letter in the word __________ and say the letter to yourself. Shut the tape off to do this. Turn the card over. Now take the letters out of the pockets and mix them up on the table. Stop the tape and start it when finished. Now place the letters back into the pockets to make the word __________. Stop the tape to do this. Now write the word __________ on yellow sheet #2 and place it in the mailbox. Shut the tape off to do this and turn it on when ready. Check your letters in the pockets to make sure they are in the correct order. Use the card to check your letters. Stop the tape and start it when ready. Now take the blue booklet and print the first letter of the word ___________ in the space provided on the first page. Check the card to make sure you are correct. Now turn the page and print the 1st and 2nd letters of the word __________ and then check the card to make sure you are correct. Continue on your own until you have completed the last page of the blue booklet. Be sure to check each page before you turn to the next one. Turn off the tape to do this and turn it on when you are finished. Please put your name on the booklet and place it in the mail box. You have finished practicing the word __________. Clean off the laminated card and place all of the materials back where you found them. Stop the tape to do this and turn it on when ready. Please print the word __________ on yellow sheet #3 and place it in the mail box. Turn the tape off and turn it on when ready.

Spelling Task to Follow CAP Task 16

Steps to Follow:

1. Student finds the correct envelope for the spelling word (envelopes are numbered). Inside the envelope are the materials required:
   - language master card (side 1 and side 2)
   - letter cards inside a small white envelope (15 letters in each envelope)
   - 3 yellow sheets numbered 1, 2, 3

   respectively. Student's spelling word is recorded on the language master card. On side (1) the word is said and then used in a sentence. On side (2) the word is spelled ie.

   Side (1) turkeys - turkeys are birds.

   (2) t - u - r - k - e - y - s

   Student takes everything out of the envelope.

2. Student is instructed to listen to side one of the language master card. Then student is to print the spelling word he heard on yellow sheet numbered (1) and place it in the box beside him. Student is reminded to check that his name is on the sheet. (The sheets have been predated.)

3. Then student is to empty the letters from the white envelope and arrange them in a line.

4. Then the student listens to side 2 of the language master card.

5. The student has extra letters. He must choose the correct ones to make the word after he has heard the spelling. The letters are spread out on the table. He must choose from the selection - 10% of the spelling words will have misinformation ie. not all of the required letters will have been included - the student will be encouraged to solve the problem.

6. Student then listens to side 2 again to check his arrangement. If there are errors student

fixes them and then checks by listening once more.

7. Student mixes up the letters and repeats steps 4 through 6 two more times.

8. Now the student writes his arrangement for the spelling word on the yellow sheet numbered (2). The student then places this sheet in the box beside him.

9. The student puts everything back in its place and then writes the spelling word on the yellow sheet numbered (3) and then places it in the box.

Spelling Task to Follow CAP Task 18

The student is given a brown envelope containing

- a tape
- letters in a small white envelope
- 1 laminated card
- 3 strips of paper numbered 1 - 2 - 3 stapled into a booklet
- the date is on the sheet

Student puts tape on to listen to instructions.

Tape Instructions:

The word you will be practicing to spell is ________. In front of you are three yellow strips of paper. Please print the word __________ on the yellow sheet numbered (1). Be sure your name is on the sheet. Shut the tape off to do this and then turn it on again when you are finished. Now place the yellow sheet in the mailbox in front of you. Take the card from the envelope with number _____ on it and place it in front of you. Stop the tape to do this and turn the tape on when ready. Be sure that side one of the card is facing you. Using a felt pen, trace over the letters you see. Stop the tape and do this, start the tape when you are finished. These letters spell __________. Draw a line from the _____ to the _____. Draw a line from the _____ to the _____, etc. Now print the letters in order on the lines below to make the word __________. Turn off the tape to do this and turn it on when you are finished. Please turn the card over and print the word ________ on the spaces provided. Stop the tape and do this. Now print the word __________ on the yellow sheet numbered 2, the same way you did on the card and place it in the mail box. Stop the tape to do this and then start again when finished. Now check the letters on your card by turning the card over to side one. We have finished practicing the word _________. Please clean off both sides of the card with a wet cloth and place it back into the envelope. Turn off the tape to do this and turn it on again when ready. With your pencil, print the word __________ on the yellow sheet of paper numbered 3 and place it in the mailbox. Be sure your name is on it. Shut the tape off to do this and turn it on when you are finished.

Review Instructions:

The spelling words you have been practicing are:

__________, __________, __________, __________.

Listen carefully to a story that has your spelling words in it. Now, on the card in front of you, draw a line with a felt pen to connect your spelling words as you heard them occur in the story. Start with the first word you heard and join it to the second word you heard. Then join the second word you heard to the third word you heard and finally join the third word to the last word you heard. Shut the tape off to do this and turn it on when ready. To check your work listen to the story again. Rewind the tape to do this.

CHAPTER V

RESULTS AND DISCUSSION

The major purpose of this study was to measure the effect an intervention program had on a subgroup of reading disabled students' ability to spell words accurately. The intervention program combined Das and Conway's (1986) remedial program CAP, with a spelling program that was designed to reflect the principles embedded in the specific CAP tasks.

Four main hypotheses were proposed to determine the effectiveness of the intervention program.

Findings Related to Process Improvement

Hypothesis 1: Greater improvement on the successive measures for the Experimental Group than for the Control Group.

A pre/post test improvement was expected for both Experimental and Control Groups on the successive subtests. It was anticipated, however, that the Experimental Group would make greater gains due to the remediation program that focused on the training of successive processing strategies.

A two-sample Hotelling T^2 test was used to examine the pre-test results of the K-ABC successive subtests. "This test is the multivariate analog of the familiar 2 independent sample t test" (Hunka, S. & Bay, K., 1983, p. 1). Pre-test means and standard deviations for the Experimental and Control Groups, on each of the three successive subtests, are presented in Table 2. No significant differences between the means of each group was obtained (T**2=5.039, DF1=3, DF2=16, F-ratio=1.493045 and Probability=0.25436).

To determine pre/post test improvement, and the effect of remediation, a two-way analysis of variance with repeated measures was performed for the sequential subscale (sum of the three successive subtests). A 2x2 factorial design was used with Factor A being Groups, i.e., Experimental/Control, and Factor B being Test Scores over Time, i.e., Pre/Post. Pre and Post-test means and standard deviations for both groups are shown in Table 2. Significant main effect for Factor B (Pre/Post) was obtained indicating improvement on the successive subscale for both groups, over time. Table 3 illustrates the analysis of variance for the sequential subscale.

Table 2

Pre and Post-Test Means and Standard Deviations for the K-ABC Sequential Subtests for Both the Experimental and Control Groups

		Means		Standard Deviation	
	Variables	Pre	Post	Pre	Post
Experimental Group	Hand Movements	7.2	7.8	1.9322	2.0440
	Number Recall	6.8	9.7	2.7807	3.2677
	Word Order	7.5	9.7	1.5092	2.3594
	Subscale	21.5	27.2	3.6591	5.2026
Control Group	Hand Movements	8.2	8.6	2.6162	1.0750
	Number Recall	9.2	9.9	2.9740	2.9231
	Word Order	8.8	9.9	2.4855	2.0248
	Subscale	26.2	28.4	5.8080	4.1687

Table 3

Two Way Analysis of Variance With Repeated Measures (Pre, Post) for the K-ABC Sequential Subscale

Source of Variation	Sum of Squares	D.F.	Mean Squares	F Ratio	Prob
Between Subjects	697.3	19			
'A'	87.02	1	87.021	2.567	0.127
Subjects Within Group	610.3	18	33.903		
Within Subjects	400.5	20			
'B'	156.0	1	156.025	13.133	0.002*
AB Interaction	30.63	1	30.625	2.578	0.126
B X Subjects Within Group	213.9	18	11.881		

* = p<.05
** = p<.01
*** = p<.001

No AxB interaction was determined, however, as there appeared to be greater improvement made by the Experimental Group on pre/post test scores than the Control Group (Table 2), t-tests for independent groups were performed. Means and standard deviations and t-ratios for the Experimental and Control Groups are provided in Table 4. A significant difference between pre and post tests scores on the successive subscale was obtained for the Experimental Group. There was no change for the Control Group. The analyses completed, support the acceptance of Hypothesis I.

Discussion

The test scores on the successive subscales improved over time (Pre/Post) for both the Experimental and Control Groups. These results were expected due to factors such as maturation, test familiarity and possible incidental learning. However, the results of the t-tests demonstrated that improvement from pre-test to post-test was significantly greater for the Experimental Group than for the Control Group. The t-test results suggest

Table 4

T-Tests (Independent Samples): Differences Between the Pre-Test/Post-Test Means for the Experimental Control Group on the Sequential Subscale

	Variables	Number of Cases	Mean	Standard Deviation	Standard Error	t value	2-Tail Prob.
Experimental Group	Simultaneous Subscale (Pre)	10	21.5000	3.659	1.157	3.64	0.005*
	Simultaneous Subscale (Post)		27.2000	5.203	1.645		
Control Group	Simultaneous Subscale (Pre)	10	26.2000	5.808	1.837	1.45	0.181
	Simultaneous Subscale (Post)		28.4000	4.169	1.318		

* = p<.05
** = p<.01
*** = p<.001

that maturation, test familiarity and incidental learning could not have been the only factors contributing to the improvement made by the Experimental Group, that in part the intervention program could be responsible for the change.

In summary, the Experimental Group demonstrated significantly greater pre/post test gains on the successive subscale than the Control Group did. This difference in improvement is attributed to the intervention program.

Findings Related to Hypothesis Two

Hypothesis 2: The Experimental Groups' improvement on the simultaneous measures will not be greater than that of the Control Groups'.

A pre/post test improvement was anticipated for both Experimental and Control Groups on the simultaneous subtests. It was expected that the groups would be comparable in their scores as neither group had been exposed to a remedial program that focused on the training of simultaneous strategies.

To examine the pre-test results of the K-ABC simultaneous subtests, a two-sample Hotelling T^2 test was performed. Pretest means and standard deviations for the Experimental and Control Groups, on each of the five simultaneous subtests are presented in Table 5. The means of the two groups were not significantly different on each of the five simultaneous subtests (T**=1.641 DF1=5 DF2=14 F-Ratio=0.255255 Probability-0.930087).

An analysis of variance with repeated measures was performed to determine pre-post test improvement for the simultaneous subscale (sum of the five simultaneous subtests). A 2x2 factorial design was used. Factor A was Groups, i.e., Experimental/ Control, and Factor B was Test Scores over Time, i.e., Pre/Post. Post test means and standard deviations for both groups are shown in Table 5. A significant main effect for Factor B was obtained indicating improvement in the simultaneous subscale for both groups over time. This analysis is presented in Table 6.

Taking into consideration the small number of subjects involved in this study, t-tests for independent samples were calculated to examine the

Table 5

Pre-Test and Post-Test Means and Standard Deviations for the K-ABC Simultaneous Subtests for Both the Experimental and Control Groups

		Means		Standard Deviations	
	Variables	Pre	Post	Pre	Post
Experimental Group	Gestalt Closure	10.6	12.2	3.4705	3.2391
	Triangles	9.7	10.9	3.4657	3.4140
	Matrix Analogies	7.7	8.6	1.7209	2.0656
	Spatial Memory	8.7	8.8	2.4518	2.0656
	Photo Series	9.4	11.3	2.9515	2.9078
	Subscale	46.5	52.0	10.6484	12.2837
Control Group	Gestalt Closure	11.0	12.3	2.7889	3.4335
	Triangles	9.4	10.4	3.0984	3.8644
	Matrix Analogies	8.4	9.2	2.8363	2.6162
	Spatial Memory	8.3	8.7	1.8886	2.5841
	Photo Series	9.0	9.8	2.8674	2.4404
	Subscale	46.1	50.3	10.5246	10.6045

Table 6

Two-Way Analysis of Variance With One Repeated Measure (Pre/Post) for the K-ABC Simultaneous Subscale

Analysis of Variance Table

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
Between Subjects	4230	19			
A	11.02	1	11.016	0.047	0.831
Subjects Within Group	4219	18	234.361		
Within Subjects	408.5	20			
B	235.2	1	235.195	25.041	0.000***
AB	4.219	1	4.219	0.449	0.511
BX Subject Within Group	169.1	18	9.392		

* = p<.05
** = p<.01
*** = p<.001

differences in pre/post test scores obtained by the Experimental and Control Groups on the simultaneous subscale. Significant improvement was demonstrated by both groups on the pre-post test gain scores. The means, standard deviations and t-ratios are shown in Table 7. In view of these findings, Hypothesis 3 was accepted.

Discussion

The significant improvement attained by both groups on the simultaneous subscale demonstrates the extent to which maturation, test practice and incidental learning can be influencing factors. The T-tests performed, provided further support for the finding that the Experimental and Control Groups were comparable in their performance on the simultaneous measures. These results strengthen the findings related to Hypothesis 1. Since maturation, test familiarity and incidental learning were possible factors for improvement on both simultaneous and successive measures it could have been expected, with the exclusion of intervention, that the groups would be comparable on both measures. However, as the

Table 7

T-Tests (Independent Samples): Differences Between the Pre-Test/Post-Test Means for the Experimental Control Group on the Simultaneous Subscale

	Variables	Number of Cases	Mean	Standard Deviation	Standard Error	T Value	Degrees of Freedom	2-Tail Prob.
Experimental Group	Simultaneous Subscale (Pre)	10	46.5000	10.648	3.367	3.44	9	0.007**
	Simultaneous Subscale (Post)		52.0000	12.284	3.884			
Control Group	Simultaneous Subscale (Pre)	10	46.1000	10.525	3.328	3.84	9	0.004**
	Simultaneous Subscale (Post)		50.3000	10.604	3.353			

* = $p < .05$
** = $p < .01$
*** = $p < .001$

groups were only comparable ~~on the~~ simultaneous measures, the greater improvement attained by the Experimental Group on the successive measures can therefore be attributed to the training of successive processing strategies during intervention.

In summary, the comparable improvement of the Experimental and Control Groups on the simultaneous measures demonstrates the effect of practice.

Findings Related to Hypothesis Three

Hypothesis 3: Greater improvement on the planning measures for the Experimental Group than for the Control Group.

It was anticipated that both the Experimental and Control Groups would demonstrate pre/post test improvement on the planning subtests. However, it was expected that the Experimental Group would make greater gains as a result of the successive processing training which included a strong component of planning as well.

A two-sample Hotelling T^2 test was used to examine the pre-test results of the Visual Search subtest. Pre-test means and standard deviations for both groups on each of the variables are shown in Table 8. No statistical significance was found to exist between the Experimental and Control Groups. Table 9 provides details of these results.

A t-test was performed to analyze the pre-test results of the Crack the Code subtest. Pre-test means and standard deviations for the Experimental and Control Groups are provided in Table 10. The groups did not demonstrate a significant difference in their pretest scores. Table 11 provides details of this finding.

To determine if a difference existed between the Experimental Group and the Control Group on the pre-test results of the Planned Connection subtest, a two-sample Hotelling T^2 test was performed. Pre-test means and standard deviations for both groups on each of the items is provided in Table 10. The results of the t-test indicated that there was no significant difference between the groups on the Planned Connection items. The Hotelling T^2 ratios are given in Table 12.

Table 8

Pre-Post Test Means and Standard Deviations for the Planning Subtest Visual Search for Both the Experimental and Control Groups

	EXPERIMENTAL				CONTROL			
	Means		Standard Deviations		Means		Standard Deviations	
Variables	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Automatic Subtests (in seconds)								
Picture Among Number	11.19	9.14	2.72	1.46	10.22	9.08	1.89	2.21
Number Among Picture	23.28	19.28	6.31	7.66	24.85	20.01	10.00	11.33
Total Automatic Search	34.47	28.73	8.15	8.09	35.08	29.10	11.16	12.70
Control Subtests (in secons)								
Number Among Number	40.97	35.44	17.39	8.48	37.43	35.87	12.25	10.52
Picture Among Picture	39.31	34.01	13.87	6.99	38.87	36.74	6.62	9.98
Letter Among Letter	41.50	33.01	21.98	12.47	42.44	48.52	19.90	22.15
Total Control Search	121.78	102.94	49.34	19.48	118.75	121.15	25.95	29.88

Table 9

Hotelling 2-Sample T**2 Test: Differences Between the Pre-Test Means of the Experimental and Control Group on the Visual Search Subtests

Variables	T**2	DF1	DF2	F-Ratio	Probability
Picture Among Picture	2.642	4	15	0.552507	0.700272
Number Among Picture	8.652	4	15	1.778206	0.185746
Number Among Number	1.129	4	15	0.235177	0.914160
Picture Among Picture	4.788	4	15	0.997415	0.439241
Letter Among Letter	11.389	4.	15	2.372714	0.098841

* = p<.05
** = p<.01
*** = p<.001

Table 10

Pre-Test and Post-Test Means and Standard Deviations for the CAS Planning Subtests: Crack the Code and Planned Connections for Both the Experimental and Control Groups

		Means		Standard Deviations	
	Variables	Pre	Post	Pre	Post
	Crack The Code	1.8	3.8	2.201	1.751
Experimental Group	Planned Connections (in seconds)				
	Easy-Items 7+8	85.18	63.53	36.219	19.53
	Hard-Items 9+10	186.82	137.80	69.20	67.54
	Crack The Code	3.1	3.8	1.792	1.814
Control Group	Planned Connections (in seconds)				
	Easy-Items 7+8	86.81	77.70	22.24	30.13
	Hard-Items 9+10	173.30	150.46	51.00	40.12

Table 11

T-Test (Independent Samples): Differences Between the Pre-test Means for the Experimental and Control Group on the Crack the Code Subtest

	Variable	Number of Cases	Mean	Standard Deviations	Standard Error	T Value	Degrees of Freedom	2-Tail Prob.
	Crack The Code							
Experimental Group		10	1.8	2.201	0.696			
						1.45	18	0.165
Control Group		10	3.1	1.792	0.567			

Table 12

Hotelling 2-Sample T**2 Test: Differences Between Pre-Test Means for the Experimental and Control Group on the Planned Connections Subtest

Variables	T**2	DF1	DF2	F-Ratio	Probability
Item 7 and Item 8	3.622	2	17	1.710273	0.210495
Item 9 and Item 10	0.887	2	17	0.418826	0.664425

A two-way analysis of variance was performed for each of the CAS planning subtests. This analysis provided for the examination of pre-post test improvement and the efficacy of remediation. A 2x2 factorial design was used. Factor A represented Groups, i.e., Experimental/Control, and Factor B represented Test Scores over time, i.e., Pre/Post (repeated measures). The post-test means and standard deviations for Visual Search are presented in Table 11. Table 10 provides the post-test means and standard deviations for Crack the Code and Planned Connections. Significant main effects for Factor B (Pre-Post were obtained for Visual Search subgroup - Total Automatic Serach; Crack the Code and Planned Connections - Items 7 and 8 and Items 9 and 10, indicating that the Experimental and Control Group demonstrated improvement in scores over time. A significant AxB interaction was obtained for Planned Connections (Items 9 plus 10). This interaction is illustrated in Figure 1 and Tables 13 through 17 provide the analyses of variance for each of the planning subtests.

T-tests for independent samples were performed to examine the differences in pre/post test results

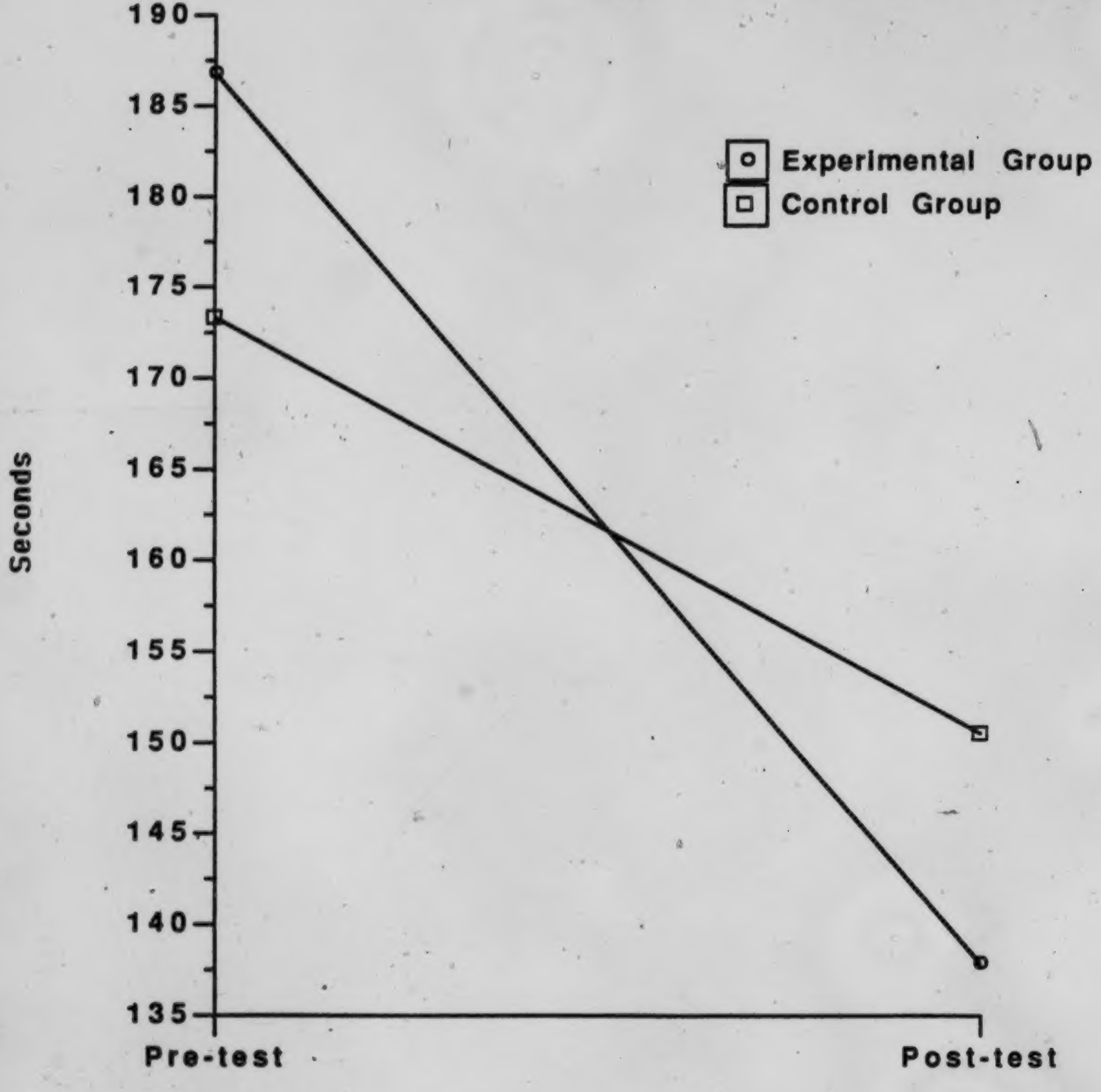


FIGURE 1. Planned Connections: Items Nine Plus Ten Mean Scores on Pre- and Post-tests for the Experimental and Control Groups

Table 13

Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) for Automatic Search (Picture Among Number Plus Number Among Picture)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
A	24000.004	1.	24000.004	0.015	0.902
S-Within	27924992.000	18.	1551388.000		
B	3432160.000	1.	3432160.000	6.372	0.021*
AB	1600.000	1.	1600.000	0.003	0.957
BS-Within	9695232.000	18.	538624.000		

* = $p<.05$
** = $p<.01$
*** = $p<.001$

Table 14

Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) for Total Control Search (Number Among Number, Picture Among Picture, Letter Among Letter)

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
A	5762561.000	1	5762561.000	0.348	0.562
S-Within	277848832.000	18	16547157.000		
B	6766081.000	1	6766081.000	1.252	0.276
AB	11276803.000	1	11276803.000	2.104	0.164
BS-Within	96485376.000	18	5360298.000		

* = p<.05
** = p<.01
*** = p<.001

Table 15

Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) for Crack the Code

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
Between Subjects	70.88	19			
'A'	4.225	1	4.225	1.141	0.300
Subjects Within Group	66.65	18	3.703		
Within Subjects	85.50	20			
'B'	18.22	1	18.225	5.203	0.035*
AB Interaction	4.225	1	4.225	1.206	0.287
B X Subjects Within Group	63.05	18	3.503		

* = p<.05
** = p<.01
*** = p<.001

Table 16

Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) for Planned Connections Subtest (Items Seven Plus Eight)

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
A	6244961.000	1	624961.000	0.472	0.501
S-Within	237933824.000	18	13218545.000		
B	23643680.000	1	23643680.000	10.457	0.005**
AB	3926881.000	1	3926881.000	1.738	0.204
BS-Within	40659456.000	18	2258858.000		

* = $p<.05$
** = $p<.01$
*** = $p<.001$

Table 17

Two-Way Analysis of Variance With One Factor Repeated (Pre,Post) for Planned Connections Subtest (Items Nine Plus Ten)

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
A	17920.004	1	17920.004	0.000	0.987
S-Within	1147281408.000	18	63737856.000		
B	129088032.000	1	129088032.000	31.658	0.001***
AB	17141760.000	1	17141760.000	4.204	0.055*
BS-Within	73396224.000	18	4077568.000		

* = $p < .05$
** = $p < .01$
*** = $p < .001$

obtained by the Experimental and Control Group on the following subtests: Crack the Code, Planned Connections (items 7 plus 8) and Total Automatic Search. A significant difference between pre and post test scores on Planned Connections (items 7 plus 8) and Total Automatic Search was obtained for the Experimental Group. The Experimental Group's performance on Crack the Code was nearly significant. No change was obtained for the Control Group. The means, standard deviations and t-ratios are provided in Tables 18 and 19. The analyses completed, supports the acceptance of Hypothesis 2 for certain subtests.

Discussion

Improvement on all the planning measures with the exception of the Controlled Search items was noted for both groups. This improvement can be attributed to prior test experience, maturation and learning that may have involved attributes similar to those required in the planning tests.

The AxB interaction obtained for Planned Connections (items 9 plus 10) and the results of the

Table 18

T-Tests (Independent Samples): Differences Between Pre-Post Test Means for the Experimental Group on Total Automatic Search, Planned Connections (Items 7 Plus 8) and Crack the Code

Variable	Number of Case	Means	Standard Deviations	Standard Error	2-Tail Corr.	2-Tail Prob.	T Value	Degrees of Freedom	2-Tail Prob.
Crack The Code (Pre)	10	1.8000	2.201	0.696	0.012	0.975	2.24	9	0.0528
Crack The Code (Post)		3.8000	1.751	0.554					
Total Automatic Search (Pre)	10	3477.000	815.324	257.828	0.787	0.007	3.42	9	0.008**
Total Automatic Search (Post)		2873.4000	809.055	255.846					
Planned Connections (Pre) (Items 7+8)	10	8518.1000	3621.092	1145.090	0.754	0.012	2.73	9	0.023*
Planned Connections (Post) (Items 7+8)		6353.8000	1953.793	617.843					

* = $p<.05$
** = $p<.01$
*** = $p<.001$

Table 19

T-Tests (Independent Samples): Differences Between Pre-Post Test Means for the Control Group on Planned Connections (Items 7 Plus 8) and Crack the Code

Variable	Number of Case	Means	Standard Deviations	Standard Error	2-Tail		T Value	Degrees of Freedom	2-Tail Prob.
					Corr.	Prob.			
Crack The Code (Pre)	10	3.1000	1.792	0.567	0.075	0.836	0.90	9	0.390
Crack The Code (Post)		3.8000	1.814	0.573					
Total Automatic Search (Pre)	10	3508.2000	1116.388	353.033	0.348	0.324	1.38	9	0.200
Total Automatic Search (Post)		2910.1000	1270.648	401.814					
Planned Connections (Pre) (Items 7+8)	10	8681.7000	2224.051	703.307	0.840	0.002	1.73	9	0.118
Planned Connections (Post) (Items 7+8)		7770.7000	3013.128	952.835					

t-tests for Crack the Code, Planned Connections (items 7 plus 8) and Automatic Search, suggest the intervention program was a factor for the greater improvement in performance displayed by the Experimental Group. No significant main effect for Factor B (pre/post) was obtained for the Controlled Search items indicating that neither group demonstrated significant improvement. A possible explanation for this finding may be found in the analyses of the Controlled Search items. These items involved locating an item among an item, a number among a number and a letter among a letter. These tasks demanded more focused attention and greater discrimination as the items were among category-alike items. Compared to the Automatic Search items, the Controlled Search items are more distracting and therefore more difficult. Improvement would therefore be more difficult to attain.

In summary, the significant difference obtained by the Experimental Group on Crack the Code, Planned Connections and Automatic Serach can be attributed to the intervention program.

Findings Related to Spelling Improvement

Hypothesis 4: Greater improvement on the Spelling Assessment for the Experimental Group than for the Control Group.

It was expected that the Experimental and Control Group would demonstrate pre-post test improvement on the Test of Written Spelling as a result of spelling remediation experienced by both groups during the intervention phase. However, it was anticipated that the Experimental Group would obtain greater improvement due to the training of successive processing strategies during intervention. Successive processing has been found to correlate highly with spelling (Kaufman and Kaufman, 1983).

Further, it was anticipated that because the remediation program focused on successive processing, the Experimental Group's improvement on the Unpredictable subtest would be significantly greater than that of the Control Group.

To assess the pre/post test scores and the potential effect of the intervention program an analysis of variance was performed. A 2x2x2 factorial design was used. Factor A was Groups, i.e., Experimental/Control, Factor B was test scores over time, i.e., Pre/Post (repeated measures) and Factor C was Word Type, i.e., Predictable/ Unpredictable. Pre-test and Post-test means and standard deviations are shown in Table 20. Significant main effects for Factor B (Pre/Post) and for Factor C (Predictable/Unpredictable were obtained. A significant AxB interaction was found. The AxB interaction is illustrated in Figure 2. Table 21 provides the details of the analysis of variance.

The analysis of variance did not demonstrate a BxC interaction. However the means in Table 20 indicated greater improvement on the spelling measures for the Experimental Group. Therefore, it was of interest to this study to examine the extent to which the Experimental and Control Groups improved on the Predictable and Unpredictable subtests and the possible relationship of the intervention program. This was especially relevant as there is greater contribution for successive processing on the Unpredictable subtest than there is on the Predictable subtest.

Table 20

Pre-Test and Post-Test Means and Standard Deviations for the Test of Written Spelling for Both the Experimental and Control Groups

		Means		Standard Deviations	
	Variables	Pre	Post	Pre	Post
Experimental Group	Predictable Words	9.6	13.6	5.379	6.096
	Unpredictable Words	6.8	10.3	3.765	4.270
Control Group	Predictable Words	10.4	12.5	2.716	3.342
	Unpredictable Words	7.0	7.7	2.309	3.020

FIGURE 2. Test of Written Spelling. Mean Scores on Pre- and Post-tests for the Experimental and Control Groups

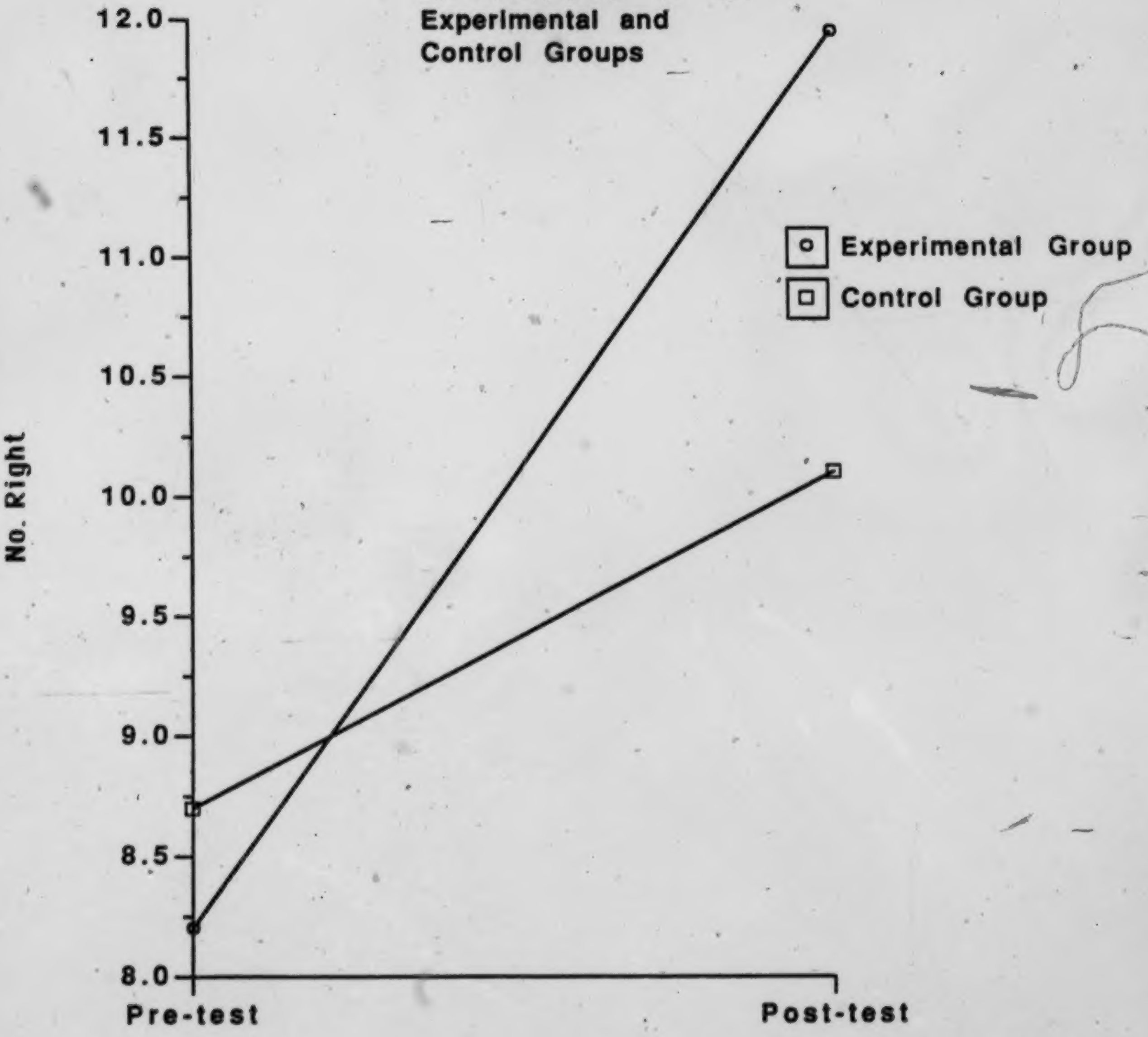


Table 21

Analysis of Variance for the Test of Written Spelling

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
A	9.114	1.	9.114	0.156	0.698
S-Within	1054.629	18.			
B	132.612	1.	132.612	68.155	0.001***
AB	27.612	1.	27.612	14.191	0.001***
BS-Within	35.023	18.	1.946		
C	255.613	1.	255.613	70.653	0.001***
AC	5.513	1.	5.513	1.524	0.233
CS-Within	65.121	18.	3.618		
BC	4.514	1.	4.514	2.829	0.110
ABC	1.011	1.	1.011	0.633	0.437
BCS-Within	28.727	18.	1.596		

* = $p<.05$
** = $p<.01$
*** = $p<.001$

An analysis of variance using 2x2 factorial design was calcualted for each subtest. Factor A was Groups (Experimental/Control) and Factor B was Test Scores over Time (Pre/Post). Significant main effects for Factor B (Pre/Post) were obtained for both subtests. Significant AxB interactions were also obtained for the Predictable and Unpredictable tests indicating that the Experimental Group achieved significantly greater gains in Pre/Post scores than the Control Group. These interactions are demonstrated in Figures 3 and 4. The details of the analyses of variance for each test is provided in Tables 22 and 23. Figure 4 provides support for the expectation that successive processing training would have a significant effect on the Experimental Group's ability to spell Unpredictable words. Based on the analyses completed, Hypothesis 4 was accepted.

Discussion

Improvement in spelling scores on the Test of Written Spelling was noted for the Experimental Group and for the Control Group. These results were anticipated, as both groups received remediation in

FIGURE 3. Test of Written Spelling. Mean Scores on Pre- and Post-tests for Predictable Words for the Experimental and Control Groups

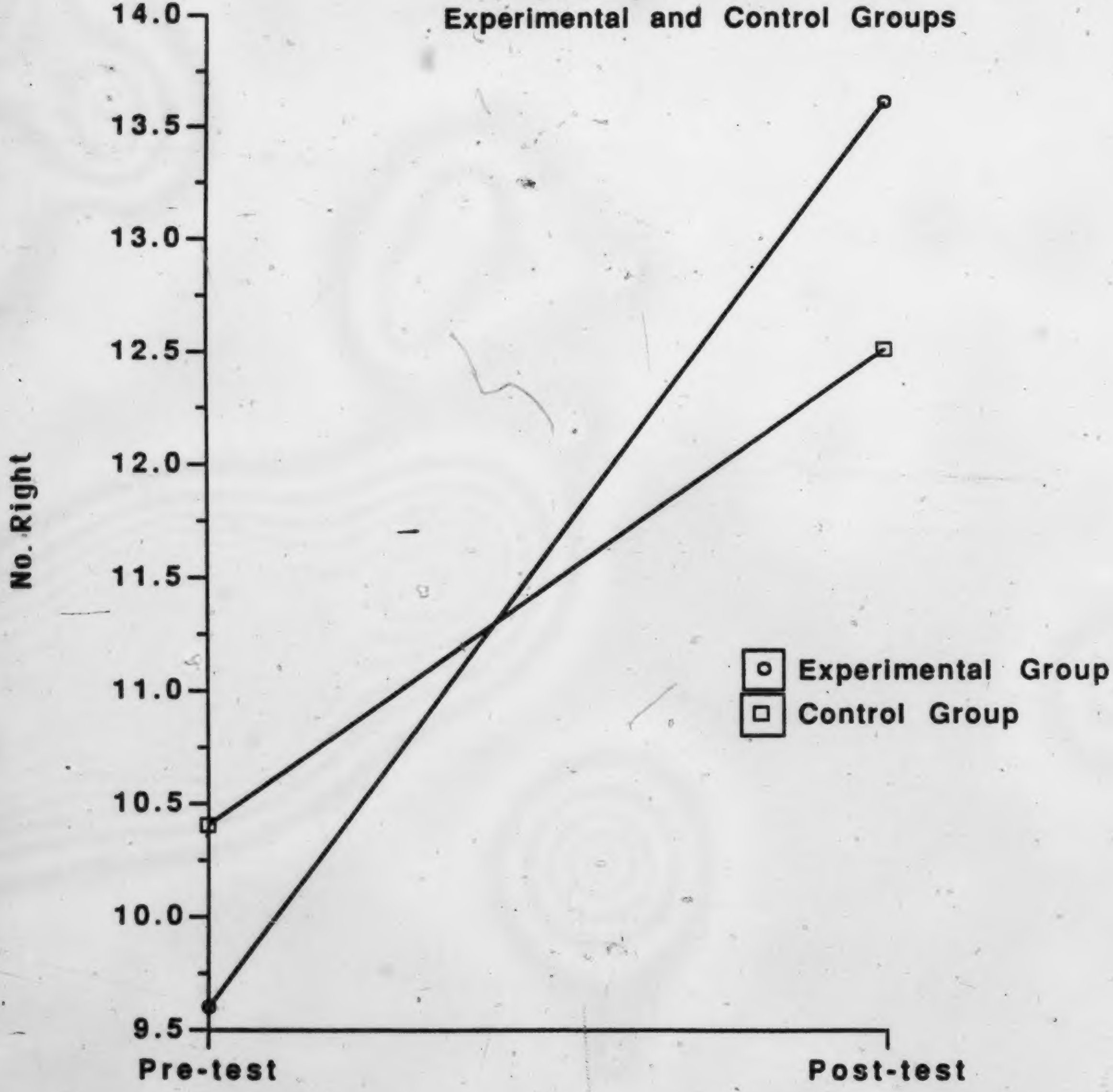


FIGURE 4. Test of Written Spelling.
Mean Scores on Pre- and Post-tests
for Unpredictable Words for the
Experimental and Control Groups

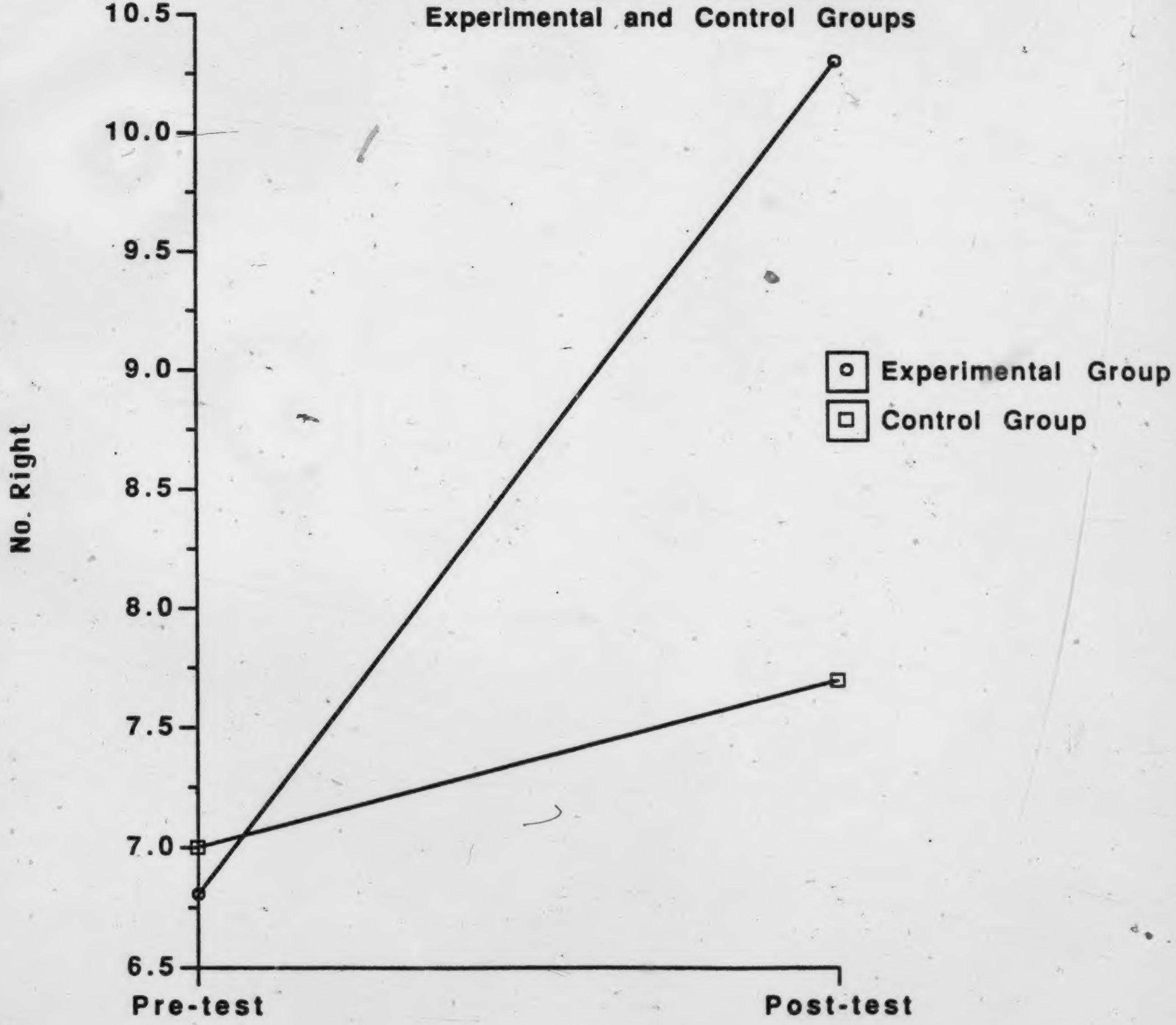


Table 22

Analysis of Variance With One factor (Pre-Post) Repeated for the Predictable Subtest

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
Between Subjects	727.5	19			
A	.2246	1	0.225	0.006	0.941
Subjects Within Group	403.3	18			
Within Subjects	136.5	20			
B	93.02	1	93.020	48.604	0.000***
AB	9.031	1	9.031	4,719	0.043*
B X Subjects Within Group	34.45	18	1.914		

*   = p<.05
** = p<.01
*** = p<.001

Table 23

Two-Way Analysis of Variance With One Factor (Pre-Post) Repeated for the Unpredictable Subtest

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
Between Subjects	406.9	19			
A	14.40	1	14.400	0.660	0.427
Subjects Within Group	392.5	18	21.806		
Within Subjects	93.00	20			
B	44.10	1	44.097	27.090	0.000***
AB	44.10	1	19.604	12.043	0.003**
B X Subjects Within Group	29.30	18	1.628		

* = $p<.05$
** = $p<.01$
*** = $p<.001$

spelling. However, the AxB interaction obtained in the 2x2x2 analysis of variance and the AxB interactions for the Predictable and Unpredictable subtests, suggest a strong relationship exists between the Experimental Group's improvement in spelling scores and the intervention program. These interactions were predicted as the intervention program emphasized successive processing training which according to Brailsford, Das & Snart (1981) and Kaufman (1983) is at the basis of spelling behavior.

The potential for improving spelling ability by training successive processing is illustrated in Figures 3 and 4. The Experimental Group's greater improvement on the Unpredictable subtest (see Figure 4) in which there is a greater demand for successive processing, demonstrates the effectiveness of training the underlying process or processes required for the successful completion of a task.

In summary, the Experimental Group demonstrated significantly greater improvement on the spelling measure. This improvement can be attributed mainly to the intervention program.

Findings Relating to the Intervention Program

The intervention program entailed thirty-five days of data collection. Daily spelling scores achieved by the students on spelling quizzes were recorded for thirty-four days. After an absence of intervention for ten days, the students were administered a final test on the words that had been tested on the thirty-fourth day of training. In an attempt to make the data more manageable, the thirty-four spelling scores of each of the students were combined over a two day span for a total of seventeen data points. The thirty-fifth score was not included. For purposes of analysis, the combined days were labelled blocks one to seventeen. Table 24 provides the spelling scores achieved by each student for each of the blocks. To illustrate the progress made by each student, graphs were prepared. The means of blocks one to eight and of ten to seventeen were determined to provide examination of the progress made by the students. The ninth block represented the median. The means that were attained are provided in Table 25 and displayed in Figures 5 through 14. Figure 15 shows the total group's

Table 24

Spelling Scores Combined Over Two Days

Student	Scores																
(1)	5	6	12	12	13	15	17	22	16	24	27	27	33	37	45	49	54
(2)	8	7	8	12	13	18	18	21	21	25	33	37	44	50	53	62	63
(3)	11	15	14	22	24	30	35	42	47	57	64	69	69	75	77	78	75
(4)	8	9	18	23	24	25	28	31	32	29	36	44	47	56	58	64	70
(5)	7	10	16	20	25	29	36	39	39	44	50	56	56	64	69	76	77
(6)	1	2	4	4	3	5	6	12	6	12	12	16	14	17	20	21	22
(7)	6	9	8	9	8	9	16	18	20	22	30	35	42	47	48	51	56
(8)	4	8	9	15	15	17	18	16	18	21	26	27	27	34	32	35	36
(9)	8	10	14	17	19	16	19	20	22	27	32	29	35	39	39	48	56
(10)	3	3	8	12	15	18	16	19	22	22	24	26	31	33	35	37	40

Table 25

Mean Scores for Spelling Blocks 1 to 8 and 10 to 17

	Means	
Students	Block 1 to 8	Block 10 to 17
1	12.75	37.00
2	13.13	45.88
3	24.13	70.50
4	20.75	50.50
5	22.75	61.50
6	4.63	16.75
7	10.38	41.38
8	12.75	29.75
9	15.38	38.13
10	11.75	31.00

FIGURE 5.
Mean Scores For Spelling Blocks 1 to 8 and 10 to 17 for Student One

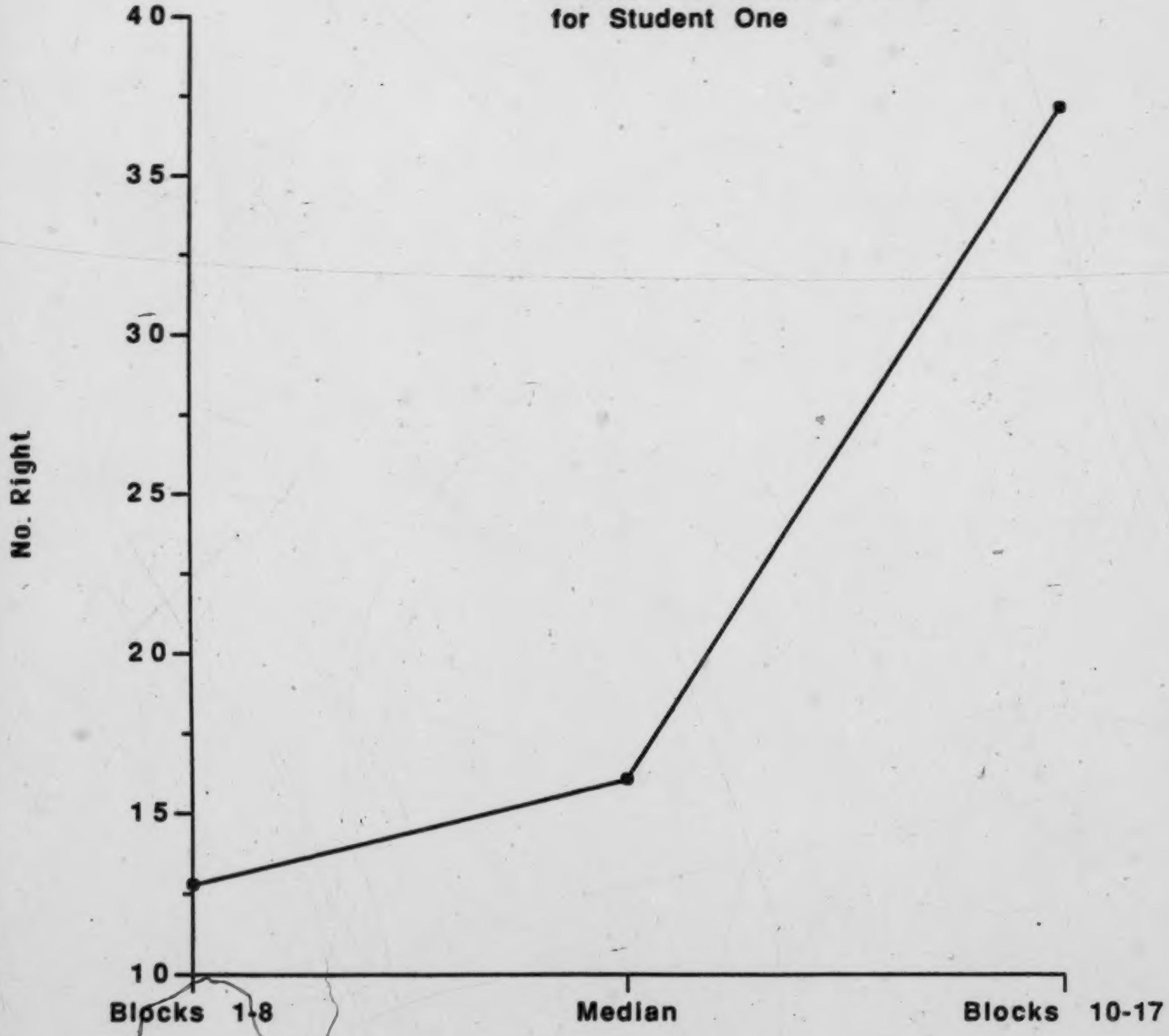


FIGURE 6.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Two

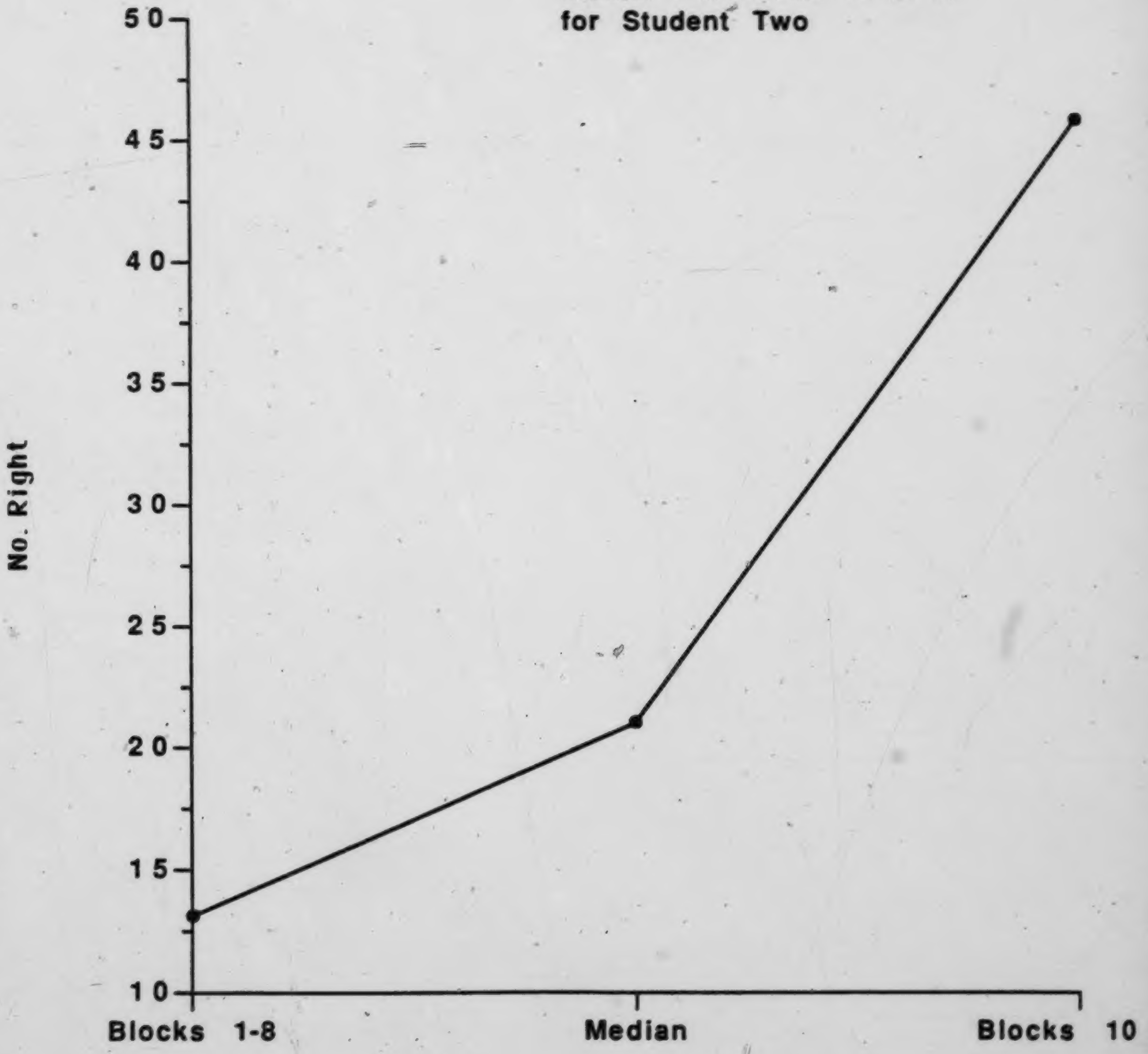


FIGURE 7.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Three

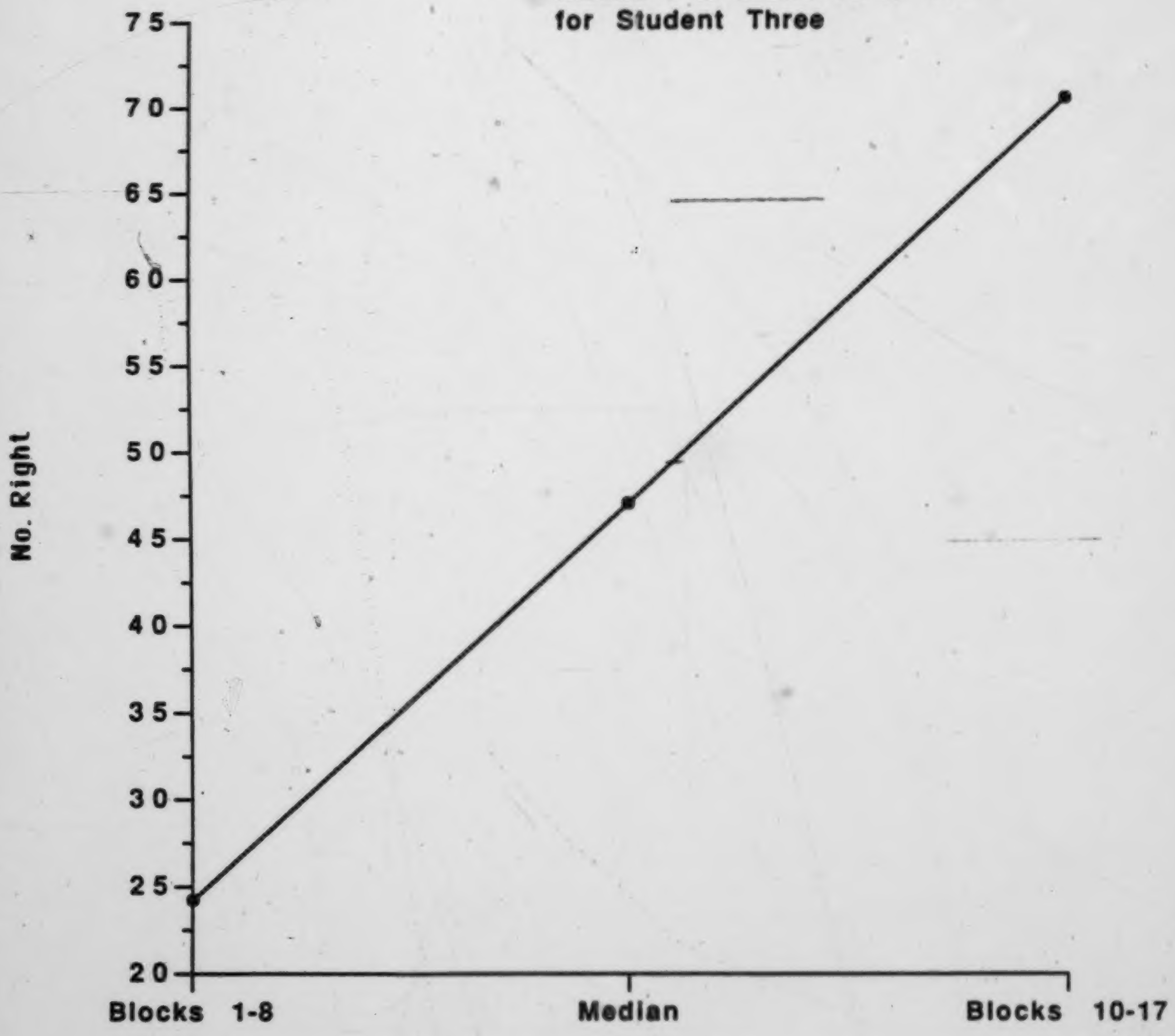


FIGURE 8.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Four

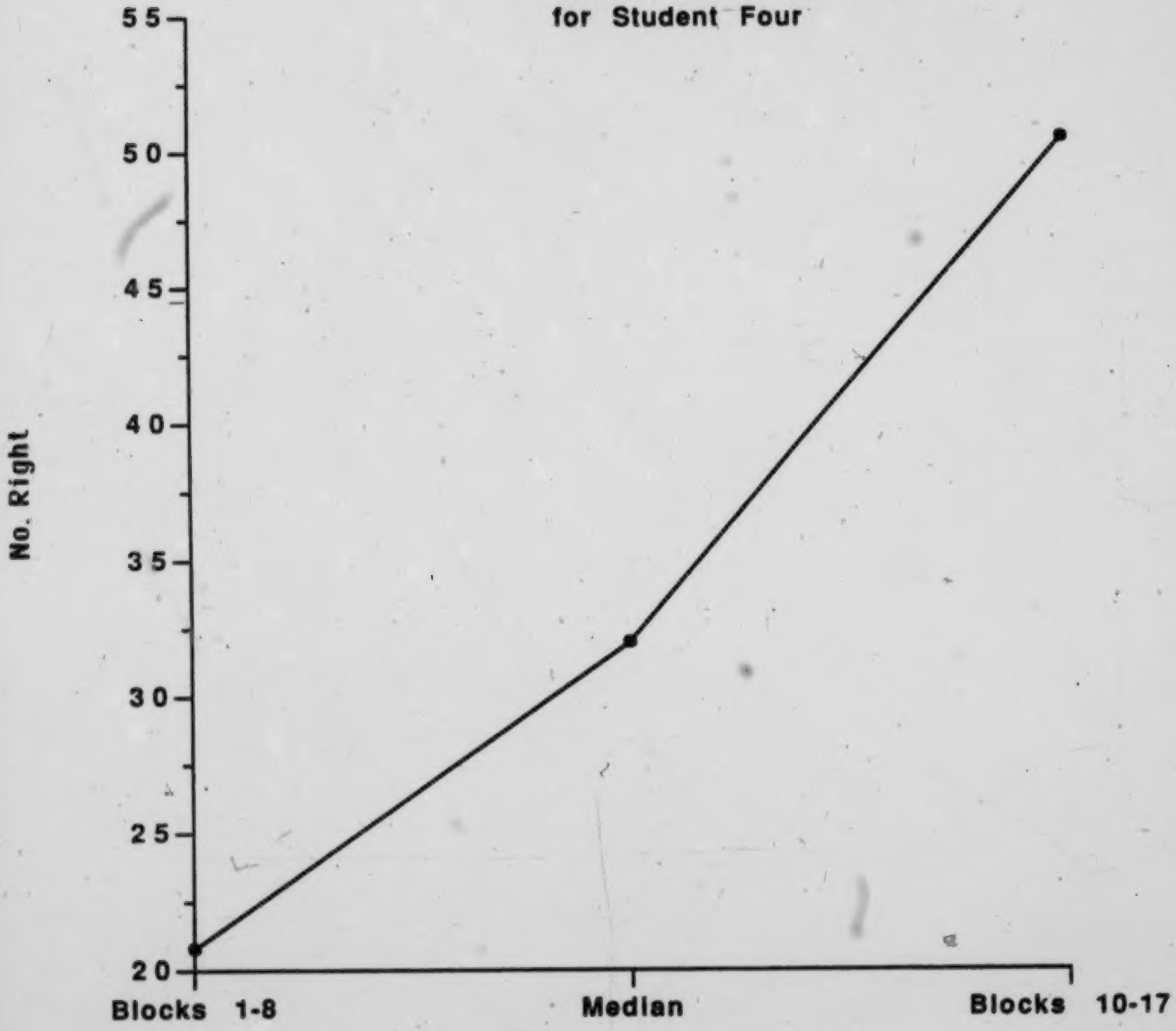


FIGURE 9.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Five

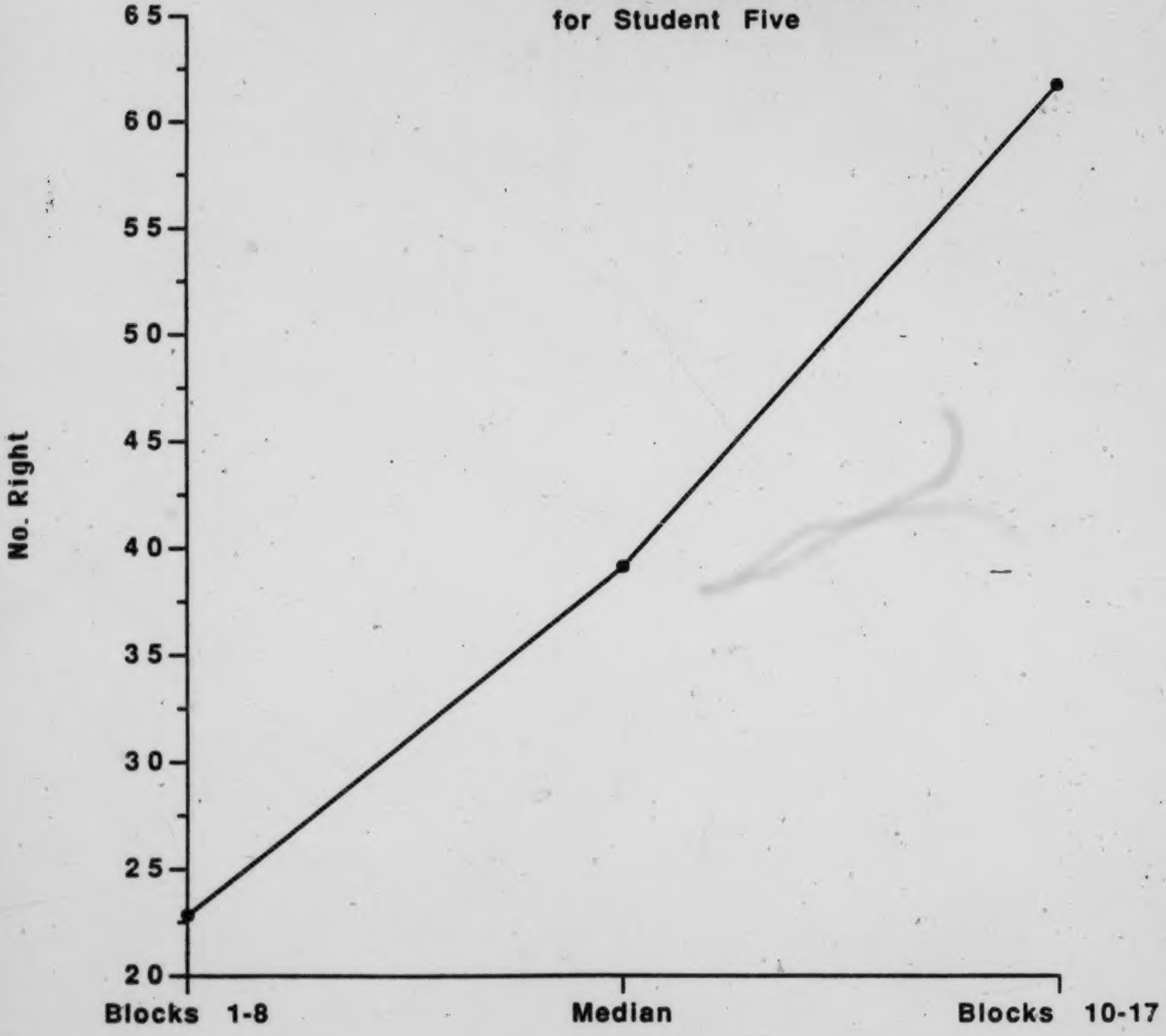


FIGURE 10.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Six

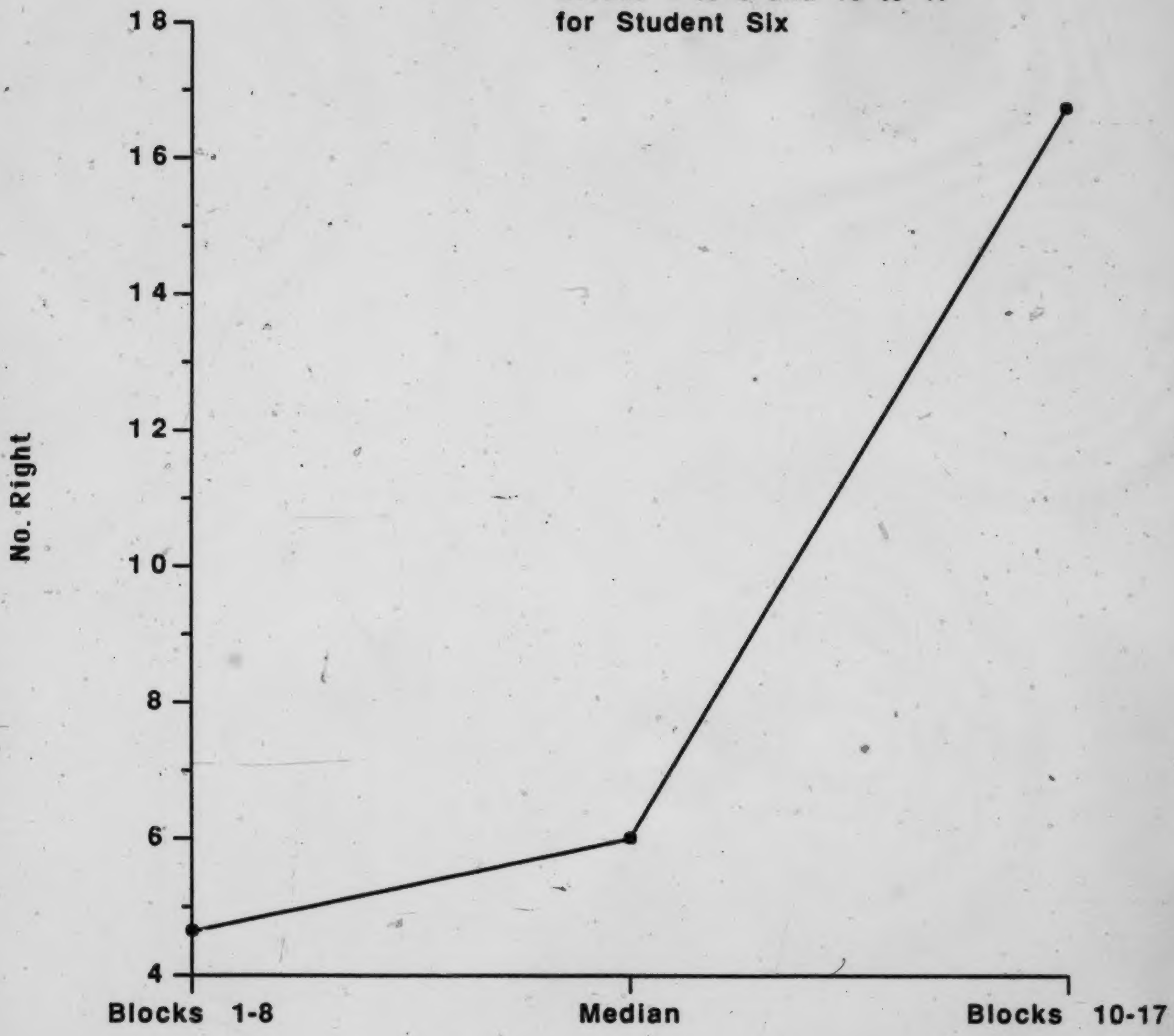


FIGURE 11.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Seven

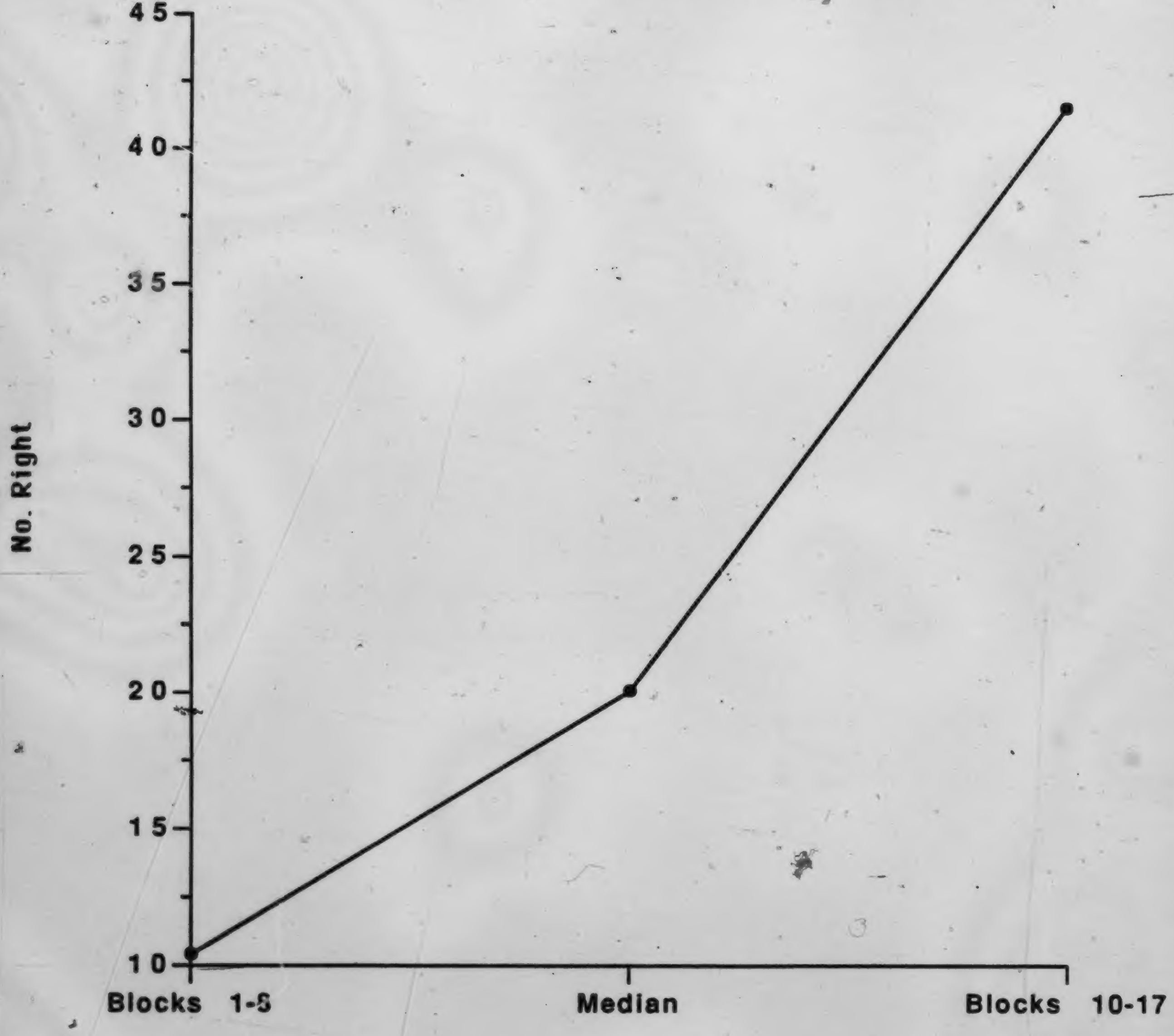


FIGURE 12.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Eight

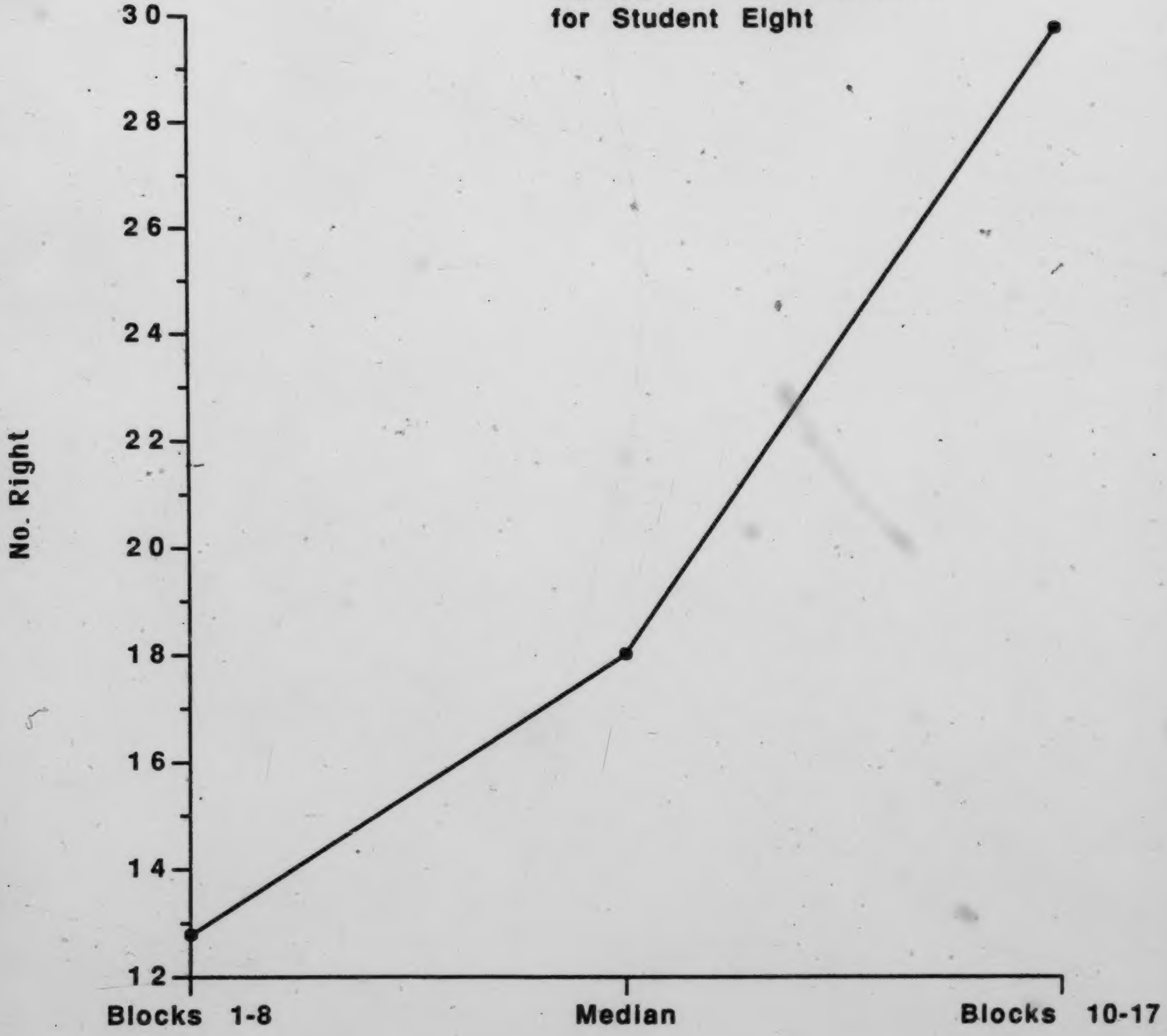


FIGURE 13.
Mean Scores for Spelling
Blocks 1 to 8 and 10 to 17
for Student Nine

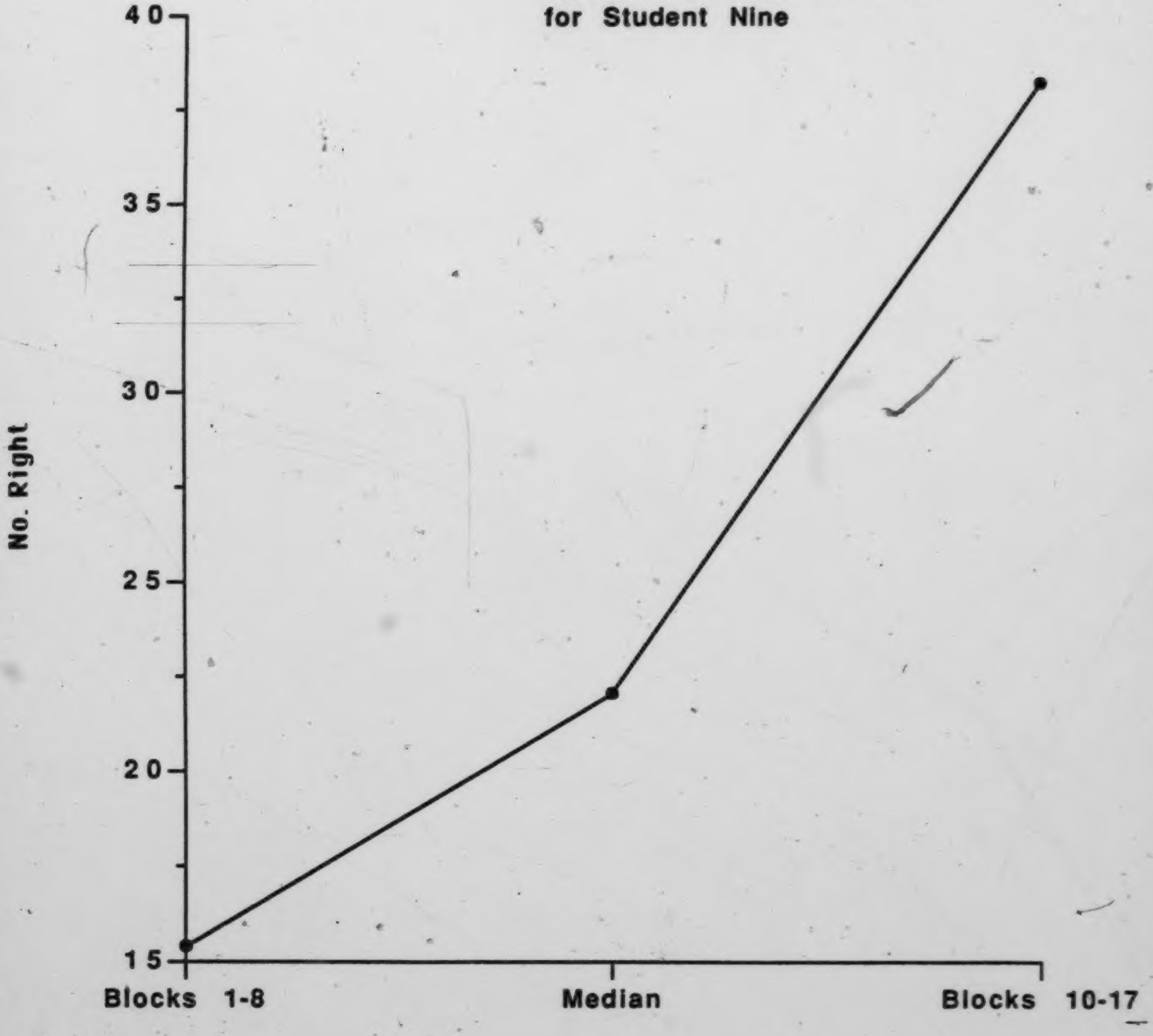


FIGURE 14.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for Student Ten

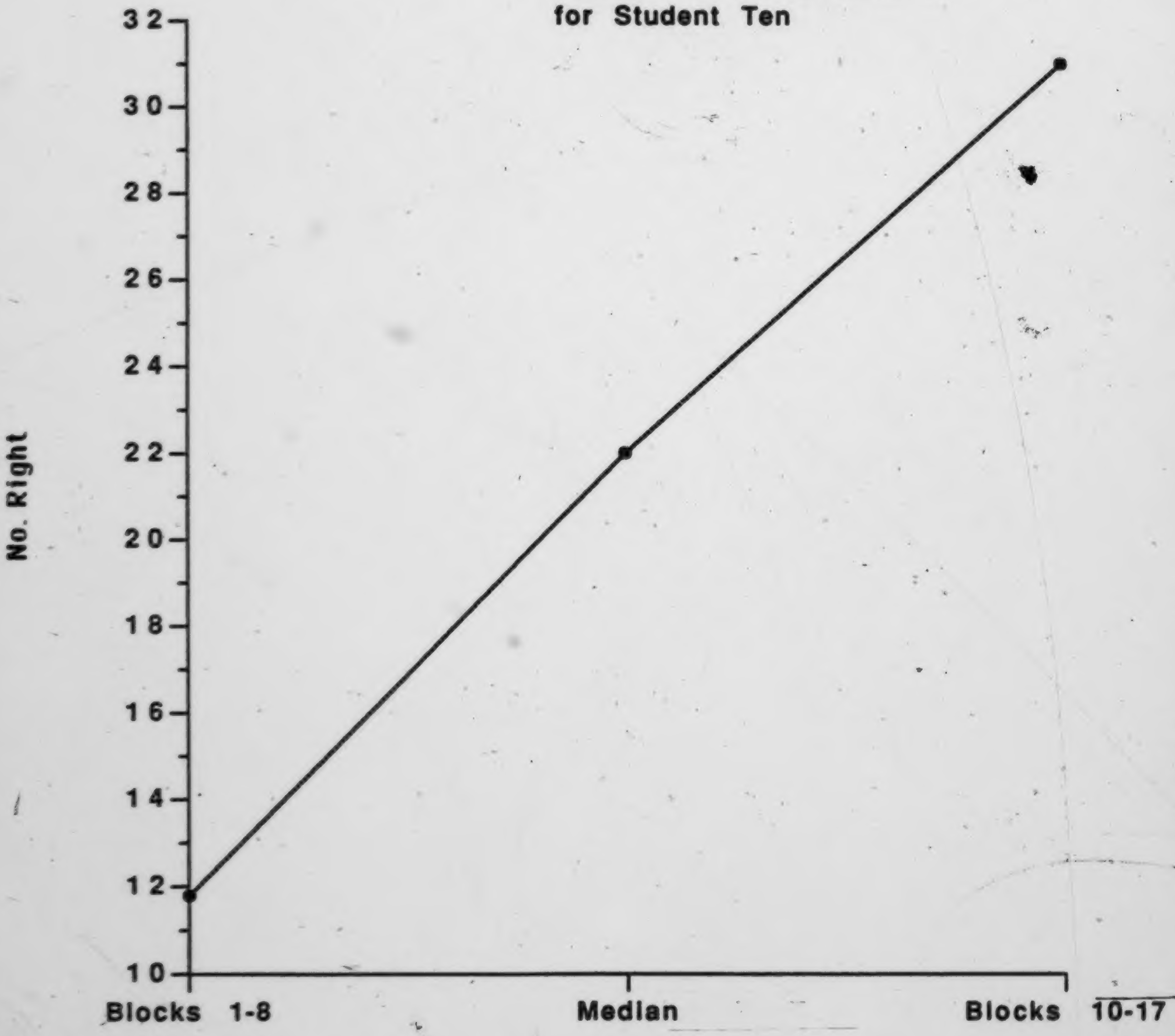
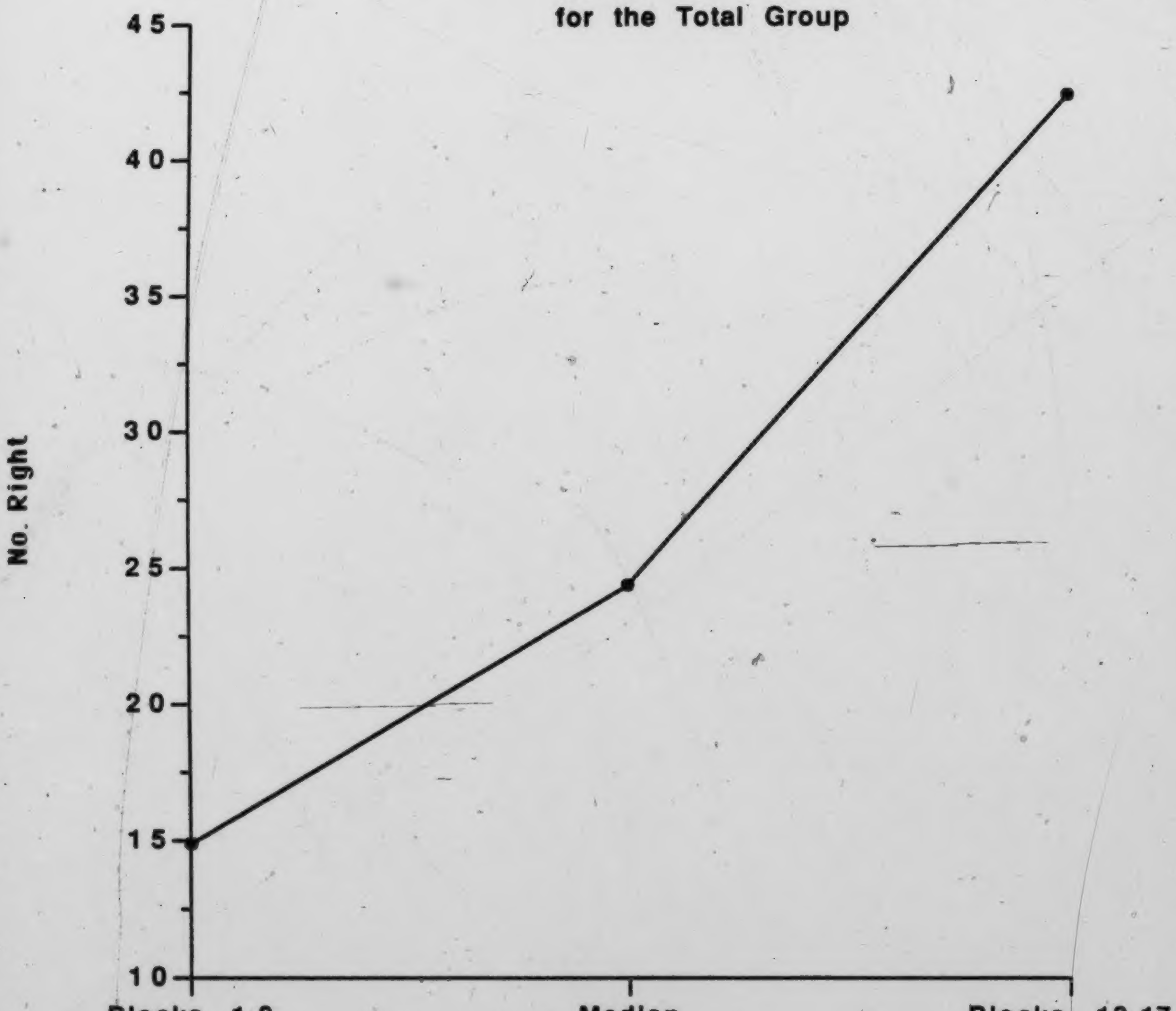


FIGURE 15.
Mean Scores for Spelling Blocks 1 to 8 and 10 to 17 for the Total Group



peformance. A t-test for dependent groups was performed to examine the difference between the students' average scores in the first and second eight blocks. A significant difference was found to exist between the mean averages. The means, standard deviations and t-ratio are presented in Table 26. A one way analysis of variance with repeated measures was employed to examine the variance within the blocks.

Means and standard deviations for each of the seventeen blocks are shown in Table 27. A significant main effect for Factor A (time) was found, indicating improvement in scores over time. Details of this analysis are provided in Table 28.

To determine the extent to which the students had retained their ability to spell words accurately, a t-test for dependent samples was used. The scores that were achieved on the thirty-fourth and thirty-fifth testing sessions were compared. No significant differences were found to exist between the sessions. The details of this analysis are shown in Table 29. Figure 16 illustrates the retention of spelling performance demonstrated by the students.

Table 26

T-Test (Dependent Sample): Difference Between the Means of the First Eight Blocks and in the Second Eight Blocks

					Pooled Variance Estimate		
Variable	Number Of Cases	Mean	Standard Deviation	Standard Error	T Value	Degrees of Freedom	2-Tail Prob.
Average of First Eight Blocks	10	14.8375	6.051	1.913	8.32	9	0.0001***
Average of Second Eight Blocks		42.2375	16.735	4.976			

* = p<.05
** = p<.01
*** = p<.001

Table 27

Mean and Standard Deviations for Spelling Blocks One to Seventeen

Blocks	Mean	Standard Deviation
1	6.1	2.923
2	7.9	3.725
3	11.1	4.383
4	14.6	6.004
5	15.9	7.233
6	18.2	8.011
7	20.9	9.978
8	24.0	9.978
9	24.3	11.898
10	28.3	12.910
11	33.4	14.431
12	36.6	15.855
13	39.8	15.512
14	45.2	16.864
15	47.6	17.335
16	52.1	18.248
17	54.9	17.798

Table 28

Analysis of Variance with Repeated Measures for Spelling Blocks One to Seventeen

Source of Variation	Sum of Squares	Degrees Of Freedom	Mean Squares	F Ratio	Probability
S-Within	17754.625	9.	1972.736		
A	38968.016	16.	2435.501	59.845	0.001***
AS-Within	5860.313	144.	40.697		

* = $p<.05$
** = $p<.01$
*** = $p<.001$

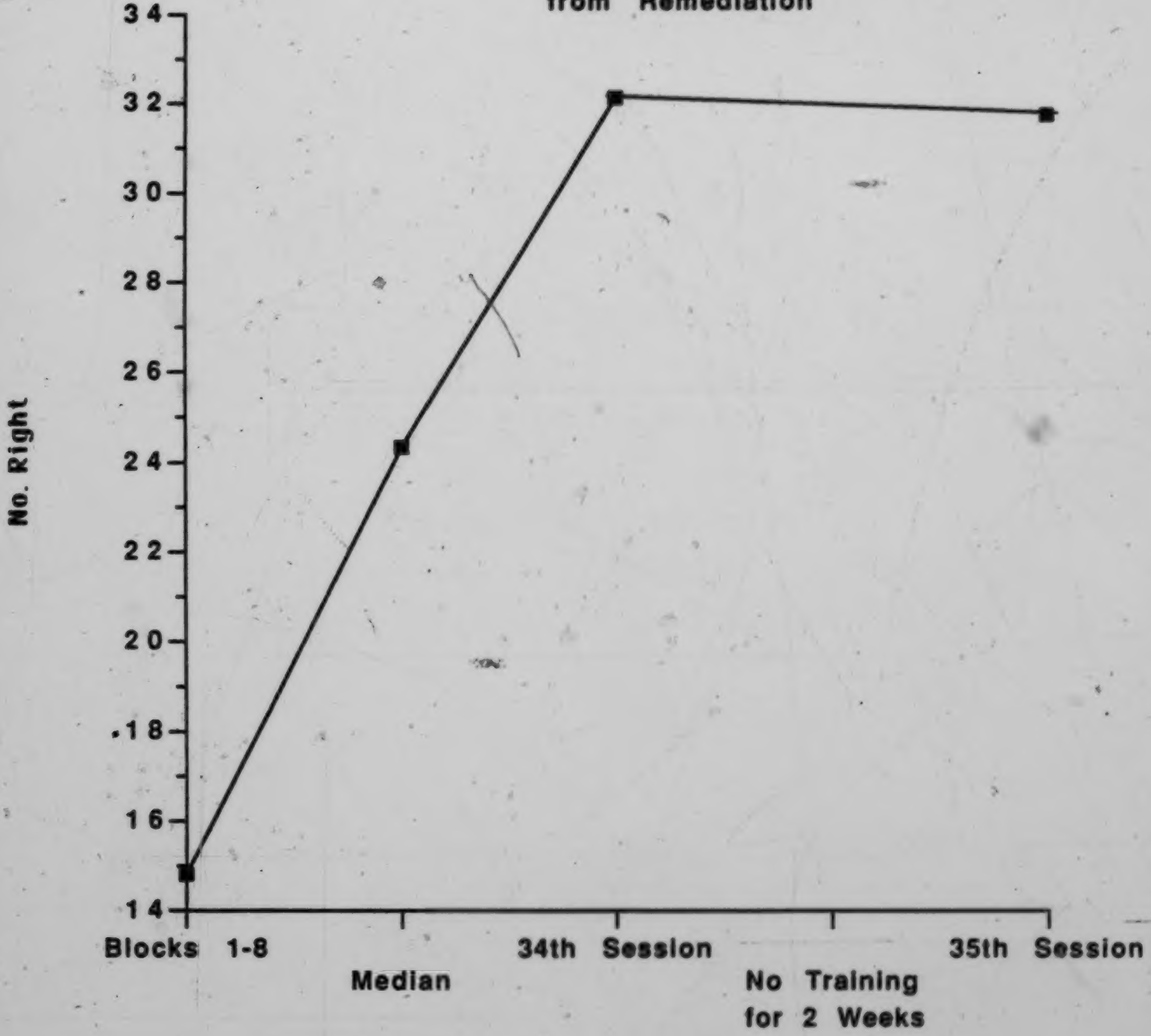
Table 29

T-Test (Dependent Sample): Difference Between the Means of the Thirty-Fourth and Thirty-Fifth Test Scores

Variable	Number Of Cases	Mean	Standard Deviation	Standard Error	T Value	Degrees of Freedom	2-Tail Prob.
Spelling Session 34	10	28.0000	8.692	2.749	-0.43	9	0.678
Spelling Session 35		28.2000	9.818	3.105			

* = p<.05
** = p<.01
*** = p<.001

FIGURE 16.
Retention of Spelling Performance for Total Group After a Two Week Break from Remediation



Discussion

All of the students involved in the remediation program demonstrated significant improvement in their ability to spell words accurately. The illustrations provided in Figures 5 through 14 verify this. The t-test calcuated between the first and second eight blocks indicated that the students' performance improved significantly over time. This finding was further substantiated by the results of the analysis of variance in which a significant main effect for Factor A (time) was found. The t-test performed between the thirty-fourth and thirty-fifth testing sessions demonstrated that the learning of spelling words during intervention had been retained by the students even after a two week break from remediation. Therefore, it can be assumed that the learning was meaningful and alludes to the effectiveness of the intervention program.

In summary, the students in the Experimental Group made significant progress in mastering spelling words. This progress is attributed to the successive processing training embedded in the CAP and spelling tasks.

CHAPTER VI

CONCLUSION

Introduction

The major focus of this study was to investigate the relationship of successive processing training to spelling achievement. The results of this study have indicated that improved successive processing ability is related to improved spelling ability. This chapter provides a summary of the study and related findings and discusses the practical implications of these findings for the learning disabled population, teachers of the learning disabled and future research in the field.

The Study and Related Findings

A relatively new direction proposed for research with learning disabilities advocates the identification of subgroups (Torgeson, 1978). In keeping with this direction, the present study identified a subgroup of twenty learning disabled students with IQ scorres of 85 or more, who were reading disabled and demonstrated severe spelling deficits. The students ranged in age from eight to twelve and were two or more years below grade level in both reading and spelling. The assumption that the act of spelling involves successive processing (Brailsford, Das & Snart, 1981; Kaufman, 1983) was accepted by this study and a remediation program was created to train successive processing strategies. The program was comprised of Global training (CAP Tasks) and Content-Specific training (Spelling tasks). The purpose of remediation was to improve successive processing ability as well as spelling ability. It was anticipated that the remedial program would facilitate improvement in both areas. The effectiveness of the remedial program was assessed in a classroom setting with an Experimental Group which included the students from the learning disabled subgroup. These students received twenty hours of continued Global and Content-Specific training. The remaining ten students represented the Control Group and received an equivalent amount of spelling remediation in a self-contained classroom setting. The effectiveness of the intervention program was determined by analyzing the pre/post test results of the K-ABC mental processing subtests; the CAS planning tests and the TWS subtests.

The results obtained indicated that the remedial program had facilitated the greater improvement achieved by the Experimental Group on the K-ABC successive subscale, CAS planning tests (Crack the Code, Planned Connections [items 9 plus 10 and items 7 plus 10] and Automatic Search items), and the TWS subtests.

Implications for the Learning Disabled

In this study, spelling, which to many learning disabled students represents an impossible hurdle, was met with success by all of the students in the Experimental Group. The students not only gained academically but also emotionally as a result of the intervention program. For the first time, they overcame the obstacle that had plagued their school experience. Being successful in an area that had previously caused feelings of inadequacy served to promote their sense of self-worth. The experience the remedial program provided will always represent a significant accomplishment for these students, something they will be able to reflect upon throughout their educational experience and perhaps life.

A remedial spelling program that produces results such as were obtained within this study holds certain implications for the overall school success of the learning disabled student. Written expression would be one area directly affected. Many learning disabled students experience frustration when writing because of their lack of spelling skill. For these children, improved spelling ability would promote confidence in their written expression. This greater confidence would serve to bring learning disabled students closer to overcoming a negative self-image resulting from negative experiences (spelling difficulties) with written work. It was observed that as the students in the Experimental Group's spelling improved, so did their confidence in their ability to write. The more readily they engaged in writing activities, the more opportunity there was for the development of written expression skills. All of the students in the Experimental Group demonstrated gains in their written expression. Appendix D provides samples of students' writing before and after intervention. Improvements made in written expression would in return have positive effects on other school related subjects such as Social Studies and Science.

Another area positively affected as a result of this intervention program was the students' language development. A strong component of the program was to encourage the students' to verbalize how they would complete the task at hand, how they might do it differently, etc. In addition, when working with their words, the students used them in a variety of sentences and stories. Essentially, the students were put into situations whereby they had to become active learners. An awareness of their own learning was developed. Evidence of this was provided when the students began to use the strategies they used during intervention in other learning situations. In addition, the focus and attention that was required of them during training was demonstrated in other areas of their program.

It is encouraging to note that this remedial program implies both academic and emotional benefits for the learning disabled student.

The significant results of this study hold promise for the potential spelling ability of learning disabled students. The assumption that the deficits demonstrated by the learning disabled in spelling are a result of a lack of ability or potential is challenged by the results obtained from this study. The Experimental Group clearly demonstrated spelling ability and the potential to continue to improve. The training of successive processing was implicated in the significant spelling improvement made by the students. The findings of this study have added to the limited bank of knowledge available on the successive processing of learning disabled students. Moreover a new direction for developing remedial programs for the learning disabled has been realized.

Implications for the Teacher of the Learning Disabled

The application of the intervention program within the classroom setting made it possible to determine its' utility. This was an essential consideration in assessing the program's potential as an effective remedial spelling program for children with learning disabilities. The results of the study imply a possible option for the special education teacher who has exhausted her/his resources in an attempt to find the appropriate remedial approach.

The materials and management components of this program will be especially appealing to teachers. The materials are simple and can be prepared by the teacher or volunteers. The management system for implementing the program in a classroom setting was designed to accommodate the nature of a self-contained special education classroom. Moreover, the training can be done by the teacher, an aid, or volunteers. Significant benefits to be gained from this program include the development of language skills, problem-solving skills, and focusing and attending ability. The most important feature of the program is that it lends well to the individual progress and levels characteristic of the learning disabled population.

A general acceptance of the remedial program by teachers will necessitate an orientation of the theoretical background and of the tasks. Hence the provision of inservices.

The potential value of the CAP program when applied to the content specific area of spelling was explored within this study. The significant results obtained indicated the effectiveness of this approach. With this knowledge, teachers who follow Torgeson's (1977) suggestion and analyze tasks in terms of their processing demands, could incorporate the CAP program in other problem areas encountered by their learning disabled students.

Implications for Future Research

Though the results of this study are encouraging, three major limitations need to be considered. First, the extent to which the researcher will be able to generalize the findings is limited as the subjects were not randomly sampled but represented intact Jr. Adaptation classes. Secondly, considering the sample size was small and only one setting was utilized, more research will be required before any conclusive remarks can be made about the findings. The final consideration is that because the "Coding, Attention, Planning" program used in this study is in a pilot stage, findings concerning this program will need to be substantiated by further research using the program in other educational settings. The mentioned considerations emphasize the need for continued research in the area. Future research could include the replication of the study on a much larger scale and in a variety of learning situations (i.e. resource rooms, integrated classrooms). It would be of interest to conduct longitudinal studies to assess the effects of the remedial program after varying time frames (i.e. one year, two years). Another focus for research could be to investigate the degree to which spelling progress made during the remedial program, generalizes to other content areas such as written expression or reading ability (sight words). The positive spelling gains made by the experimental group holds encouraging possibilities for bridging the CAP training into other Content-Specific areas. For example, it would be of interest to design a remedial program incorporating the CAP training program with a remedial program for basic facts in math or for teaching sight words. The more research that is conducted in this area, the more implications will unfold and hopefully provide more insight into the cognitive abilities of the learning disabled and the development of remedial programs.

A Final Word

Not many of the remedial methods available to teachers of the learning disabled have been associated with significant improvements in spelling ability. Since the intervention program used in this study has demonstrated this association, a possible solution to the problem of spelling difficulties may have been determined. It is therefore suggested that this intervention program may represent a viable addition to the methods available for spelling remediation.

BIBLIOGRAPHY

Bain, K. (1983). Spelling: Direct and Self-Instruction. Unpublished Masters Thesis, Department of Educational Psychology, University of Alberta, Canada.

Barron, R. (1980). Visual and phonological strategies in reading and spelling. In U. Frith (Ed.); Cognitive Processes in Spelling, (pp. 196-211). New York: Academic Press.

Bookman, M. (1984). Spelling as a cognitive developmental linguistic process. Academic Therapy, 20, 21-31.

Brailsford, A. (1981). The Relationship Between Cognitive Strategy Training and Performance on Tasks of Reading Comprehension with a Learning Disabled Group of Children. Unpublished Master's Thesis, Department of Educational Psychology, University of Alberta, Canada.

Brailsford, A., Das, J. P. Snart, F. (1981). A Process-Based Approach to Learning Disabilities. Unpublished Manuscript, University of Alberta.

Brailsford, A., Snart, F., Das, J. P. (1984). Strategy Training and Reading Comprehension. Journal of Learning Disabilities, 17, 287-290.

Bryant, N. & Gettinger, M. (1981). Effects of varying unit size in spelling achievement in learning disabled children. Journal of Learning Disabilities, 14 (4), 200-203.

Bryant, P. & Bradley, L. (1980). Why children sometimes write words which they do not read. In U. Frith (Ed.). Cognitive Processes in Spelling (pp. 357-368). New York: Academic Press.

Bryant, P. (1982). The next moves. In J. P. Das, R. F. Mulcahy & A. E. Wall (Ed.). Theory and Research in Learning Disabilities (pp. 271-281). New York: Plenum Press.

Carpenter, D. & Miller, L. J. (1982). The spelling of reading disabled LD students and able readers. *Learning Disability Quarterly*, *5*, 65-70.

Carpenter, D. (1983), Spelling error profiles of able and disabled readers. *Journal of Learning Disabilities*, *1b*, 102-104.

Das, J. P. & Naglier, J. (1986). *Cognitive Assessment System*. Edmonton, Alberta.

Das, J. P. & Conway, R. (1986). *Coding, Attention and Planning Training*. New Castle, Australia.

Das. J. P., Kirby, J. & Jarman, R. F. (1975). Simultaneous and Successive Synthesis: An Alternative Model for Cognitive Abilities. *Psychological Bulletin*, *82* (1), 87-103.

Das, J. P., Kirby, J. R. & Jarman, R. F. (1979). *Simultaneous and Successive Cognitive Processes*. New York: Academic Press.

Das, J. P. (1984). Simultaneous and successive processing in children with reading disability. *Topics in Language Disorders*, *4* (3), 34-46.

Englert, C., Hiebert, E. & Stewart, S. (1985). Spelling Unfamiliar Words By an Anaology Strategy. *The Journal of Special Education*, *19* (3), 291-306.

Fernald, G. (1943). *Remedial Techniques in Basic School Subjects*. New York: McGraw-Hill.

Flaro, (1985, October). Learning disabilities and neuro-linguistic programming: an introduction. *Focus*, p. 4-5.

Frith, U. (1980). Unexpected spelling problems. In U. Frith (Ed.), *Cognitive Processes in Spelling*, (pp. 496-514). New York: Academic Press.

Gaddes, W. (1980). *Learning Disabilities and Brain Function. A Neuropsychological Approach*. New York: Springer-Verlag.

Gentry, J. (1984). Developmental aspects of learning to spell. Academic Therapy, 20, 11-19.

Gerber, M. (1984). Techniques to teach Generalizable spelling skills. Academic Therapy, 20, 49-57.

Gerber, M. & Lydiatt, S. (1984). Research and practice in teaching spelling. Academic Therapy, 20, 5-9.

Gerber, M., & Hall, R. (1987). Information Processing Approaches to Studying Spelling Deficiencies. Journal of Learning Disabilities, 20 (1), 34-42.

Gettinger, M., Bryant, N. & Fayne, H. (1982). Designing spelling instruction for learning disabled children. An emphasis on unit size, distributed practice, and training for transfer. The Journal of Special Education, 16 (4), 439-448.

Gettinger, M. (1985). Effects of teacher-directed versus student-directed instruction and cues versus no cues for improving spelling performance. Journal of Applied Behavior Analysis, 18, 167-171.

Graham, S. & Miller, L. (1979). Spelling research and practice: a unified appraoch. Focus on Exceptional Children, 12 (2), 1-16.

Hammill, D. & Bartel, N. (1975). Teaching Children with Learning and Behavior Problems. Boston: Allyn & Bacon, Inc.

Hammill, D. & Bartel, N. (1978). Teaching Children with Learning and Behavior Problems (2nd ed.). Boston: Allyn & Bacon, Inc.

Hammill, D., Larsen, S., & McNutt, G. (1977). The effects of spelling instruction: A preliminary study. The Elementary School Journal, 78, 67-72.

Hammill, D., Leigh, J., McNutt, G. & Larsen, S. (1987). A New Definition of Learning Disabilities. Journal of Learning Disabilites, 20 (2), 109-112.

Harte, B. (1957). The spelling bee at Angel's. In W. Cole (Ed.), Story poems new and old, (pp. 78-82). Cleveland: World.

Hodges, R. E. & Hanna, P. (1966). Spelling and Communication Theory; A Model and an Annotated Bibliography. Champaign, Ill: National Council of Teachers of English.

Hunka, S. & Bay, K. (1983). Computer Program Documentation: Two-sample Hotelling T^2 Test. Unpublished Paper, Division of Educational Research Services, Faculty of Education, University of Alberta.

Johnson, D. J. & Myklebust, H. R. (1964). Learning Disabilities: Educational Principals and Practices. New York: Grune & Stratton, Inc.

Kaufman, A. & Kaufman, N. (1983). Kaufman Assessment Battery for Children. Circle Pines: American Guidance Service, Inc.

Kaufman, D. (1978). The Relationship of Academic Performance to Strategy Training and Remedial Techniques: An Information Processing Approach. Unpublished Doctoral Dissertation, University of Alberta, Canada.

Kaufman, J., Hallahan, D., Haas, K., Boren, R. (1978). Imitating children's errors to improve their spelling performance. Journal of Learning Disabilities, 11, 217-222.

Keogh, B. K. (1982). Research in learning disabilities: a view of status and need. In J. P. Das., R. F. Mulcahy, & A. E. Wall (Ed.). Theory and Research in Learning Disabilities, (pp. 27-42). New York: Plenum Press.

Kirby, J. R. & Robinson, L. W. (1987). Simultaneous and Successive Processing in Reading Disabled. Journal of Learning Disabilities, 20 (4), 243-251.

Krywaniuk, L. & Das, J. P. (1976). Cognitive strategies in native children: analysis and intervention, Alberta Journal of Educational Research, 22, 271-280.

Larsen, S. & Hammill, D. (1986). *Test of Written Spelling*. Austin: Pro-ed.

Lerner, J. W. (1981). *Learning Disabilities: Theories, Diagnosis, and Teaching Strategies* (3rd. ed.). Boston: Houghton Miflin, Co.

Luria, A. R. (1966). *Human Brain and Psychological Processes*. New York: Harper & Row, (a).

Luria, A. R. (1966). *Higher Cortical Functions in Man*. New York: Basic Books Inc., (b).

Luria, A. R. (1973). *The Working Brain*. New York: Basic Books, Inc.

National Joint Committee on Learning Disabilities (1987). Learning Disabilities: Issues on Definition (reprinted from Learning Disabilities Quarterly, 4, 336-342, 1981) *Journal of Learning Disabilities*, *20* (2), 107-108.

Nulman, H. & Gerber, M. (1984). Improving spelling performance by imitating a child's errors. *Journal of Learning Disabilities*, *17* (6), 328-332.

Otto, W. & Smith, R. J. (1980). *Corrective and Remedial Teaching*. Boston: Houghton Mifflin, Co.

Personke, C. & Yee, A. (1966). A model for the analysis of spelling behavior. *Elementary English*, *43*, 278-284.

Poplin, M., Gray, R., Larsen, S., Banikowski, A., & Mehring, T. (1980). A comparison of components of written expression abilities in learning disabled and non-learning disabled students at three grade levels. *Learning Disability Quarterly*, *3*, 46-55.

Seymour, P. & Porpodas, C. (1980). Unexpected spelling problems. In U. Frith (Ed.), *Cognitive Processes in Spelling*, (pp. 444-472). New York: Academic Press.

Thomas, V. (1974). Teaching Spelling: Canadian Word Lists and Instructional Techniques. Toronto: Gage Educational Publishing.

Torgeson, J. K. (1977). The Role of Non specific Factors in the Task Performance of Learning Disabled Children: A Theoretical Assessment. Journal of Learning Disabilities, 1977, 10 (1), 33-40.

Torgeson, J. K. (1982). The use of rationally defined subgroups in research on learning disabilities. In J. P. Das, R. F. Mulcahy & A. E. Wall (Ed.). Theory and Research in Learning Disabilities, (pp. 111-130). New York: Plenum Press.

Varnhagen, S. T. & Varnhagen, C. K. (1986). An Exploratory Study of Spelling Errors of Grade Three Students. Unpublished Manuscript, University of Alberta.

Wallace, G. & Larsen, S (1978). Educational Assessment of Learning Problems: Testing for Teaching. Boston: Allyn and Baron, Inc.

Warner, M. & Sather Bull, K. (1986). Grounding LD Definitions and Practices in Systems of Educational Thought. Journal of Learning Disabilities, 19 (3), 139-144.

Wong, B. (1986). Cognitive Approach to Teaching Spelling. Exceptional Children, 53 (2), 169-173.

APPENDIX A

STUDENTS' READING LEVELS

Burns and Roe Silent Reading Inventory

	Student	Age	Instructional Level
Experimental Group	1	12.2	Grade 3
	2	11.8	Grade 3
	3	11.2	Grade 4
	4	11.7	Grade 3
	5	10.11	Grade 3
	6	8.6	Primer
	7	11.10	Grade 4
	8	8.6	Primer
	9	10.9	Grade 3
	10	10.1	Grade 3
Control Group	1	10.0	Grade 3
	2	11.8	Grade 3
	3	10.1	Grade 4
	4	10.5	Grade 3
	5	11.1	Grade 4
	6	10.3	Grade 3
	7	11.6	Grade 3
	8	11.3	Grade 4
	9	11.9	Grade 3
	10	10.10	Grade 3

APPENDIX B

TESTS

Test of Written Spelling

Stimulus Words and Sentences

Predictable Words

Word	Sentence
stop	1. Stop talking now.
bed	2. She slept on a bed.
let	3. Please let me go.
plant	4. The plant needed some water.
him	5. She touched him on the arm.
went	6. Jim went to the store.
next	7. He is next in line.
spring	8. flowers bloom in the spring.
storm	9. The storm passed quickly.
spend	10. Did you spend the money?
shake	11. Did the baby shake the rattle?
when	12. I laughed when I saw the clown.
hardly	13. The extra point hardly mattered.
strong	14. The man was strong.
able	15. Carol was able to play.
pile	16. The boys played on a pile of dirt.

tardy	17.	Alan was tardy for school.
strange	18.	Bob heard a strange noise.
section	19.	The farmers worked one section of land.
hospital	20.	The injured player went to the hospital.
signal	21.	The cars stoped at the traffic signal.
brandish	22.	When you brandish your sword, the battle will begin.
expect	23.	We expect them to be on time.
forty	24.	He is forty years old
district	25.	The congressman campaigned in his district.
legal	26.	The judge has legal authority.
political	27.	He joined a political party.
entire	28.	The entire football team went to the game.
salute	29.	The soldiers will salute the officers.
institution	30.	The school is sometimes called an institution of learning.

Unpredictable Words

Word	Sentence
yes	1. Yes, I am going to John's house today.
she	2. She won the spelling bee.
us	3. Please come with us to the puppet show.
name	4. What is your name?
	5. There are two birds in the tree.
much	6. You didn't eat much of your breakfast
myself	7. I saw myself in the mirror.
people	8. The people were riding in the car.
who	9. Who did you see?
eight	10. The boys had eight books.
knife	11. The knife was sharp.
everyone	12. Everyone finished on time.
uncle	13. Bob's uncle took us to the park.
knew	14. Kathy knew the right answer.
nineteen	15. My brother is nineteen years old.
sure	16. Be sure to write the letter.
enough	17. Joan had enough to eat.

canyon	18.	The canyon is very deep.
fountain	19.	There was water in the fountain.
electricity	20.	Benjamin Franklin discovered electricity.
pardon	21.	I beg your pardon.
awful	22.	The medicine tasted awful.
terrible	23.	Dorothy saw the terrible storm.
bicycle	24.	Paul received a bicycle for his birthday.
community	25.	They lived in a small community.
unify	26.	Discord does little to unify a group.
agriculture	27.	Agriculture is an important part of the economy.
original	28.	The art exhibit featured original paintings.
nucleus	29.	The returning lettermen form the nucleus of a strong team.
fallow	30.	The field was left fallow.

Instructional Word Bank

caught
climbed
catch
animals
favorite
beautiful
holiday
bought
build
field
scream
course
finally
Indians
brought
except
enough
juicy
mystery
rough
dollar
soldiers
crooked
daughter
chocolate
laugh
pollution
field
beach
wolves
potatoes
turtle
turkeys
road
bicycle
received
chief
chases
information

Material compiled from Thomas (1974).

4

Subtest Planned Connections

Task Description:

The child's task in this subtest is to connect, using a regular pencil, a series of numbered boxes in correct numerical sequence as quickly as possible. There are two kinds of items in this subtest, those that include numbers and letters. The later items involve connecting the boxes using numbers and letters (1-A-2-B-3-C etc.). The score for all items is the time it takes to complete each page.

Administration Guidelines:

1. If the child makes an error during the task, the examiner should immediately say: Wait, you made a mistake, begin again from here (examiner points to the previous correct location).

2. If an error is made, do not let the child erase his error, so the time to erase does not influence the score.

3. Administer Sample A and B and Items 1-6 to grades K-2; Sample C and D and items 7-10 to grades 3-12.

4. There is time limit of 3 minutes on all items.

5. Score the time it takes to complete each item. The examiner should begin timing when the signal is given (Ready, begin) and stop timing when the child reaches the last number in the series.

6. If the child stops before the last number is reached immediately say: Keep going, you're not finished yet (or some similar statement).

C

Directions for Administration

BEGIN HERE FOR GRADES K-2

Sample A

Examiner exposes the Sample 1 page and says: What's this number (examiner points to the #1), and this number (examiner points to the #2), and this (examiner points to the #3), and this (examiner points to the #4), and this (examiner points to the #5) good. Note: if necessary, correct the child at the point of error during these instructions.

Give the child the pencil and say: Draw a line from the number 1 (examiner points to each number) to the number 2 (examiner pauses to allow the child to respond and helps if the child so he/she responds correctly). Now draw a line from the number 2 to the number 3 (examiner pauses to allow the child to respond and helps if the child so he/she responds correctly). Now from 3 to 4 (examiner pauses to allow the child to respond and helps if the child so he/she responds correctly); and 4 to 5 (examiner pauses to allow the child to respond and helps if the child so he/she responds correctly).

Sample B

Examiner exposes Sample B and says: Look at this page (pointing to page). Draw a line from the number 1 to the number 2 (pause and help the child if needed), 2 to 3 (pause and give help if needed), 3 to 4 (pause and give help if needed), and 4 to 5 (pause and give help if needed). Good.

With the Sample B page still exposed say: Now I'm going to give you some more of these to do. You should always start from the number one (examiner points to the number 1 in the double box in the Sample B) and draw a line from one number to the next until you get to the last number (Examiner points to the number 5). Work as quickly as you can without making a mistake. Do you understand? (If the child is confused, briefly explain the task and continue).

Items 1 and 2

Now do this one (Examiner begins timing).

If the child makes an error during the task, the examiner should immediately say: Wait, you made a mistake, begin again from here (examiner points to the previous correct location. Do not stop timing). This instruction may be repeated as needed.

Items 3 - 6

Now do this one (examiner exposes the item and begins timing). This direction may be used as needed on items. If the child makes an error during the task, the examiner should immediately say: Wait, you made a mistake, begin again from here (examiner points to the previous correct location. Do not stop timing). This instruction may be repeated as needed.

STOP FOR GRADES K-2

BEGIN HERE FOR GRADES 3-12

Sample C:

Examiner exposes the Sample 3 page and says: Look here, you see the numbers one (examiner points to the number), two (examiner points to the number) three (examiner points to the number), four (examiner points to the number), five (examiner points to the number), and six (examiner points to the number). Examiner gives the pencil and says: Draw a line from the number one to the number two, (pause to allow the child to do this) from the number two to the number three (pause to allow the child to do this), three to four (pause to allow the child to do this), keep going to 5 and 6. Good. If any help is needed to assure that the child responds correctly during this instruction, provide it.

Now I'm going to give you some more of these to do. You should always start from the number one (examiner points to the number 1 in the double box in the Sample C) and draw a line from one number to the next until you get to the last number (Examiner points to the last number). Work as quickly as you can without making a mistake. Do you understand? (If the child is confused, briefly explain the task and continue).

Items 7 and 8

Now do this one (examiner exposes the item and begins timing). If the child does not start immediately say: Begin. If the child makes an error during the task, the examiner should immediately say: Wait, you made a mistake, begin again from here (examiner points to the previous correct location. Do not stop timing). This instruction may be repeated as needed.

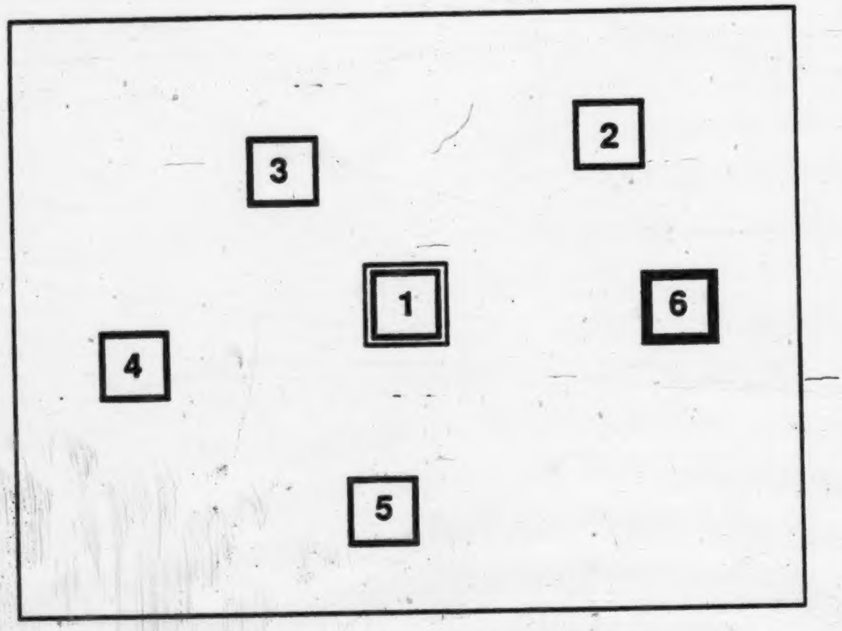
Sample D

Examiner exposes the Sample D page and says: Look here, you see there are numbers (examiner points to the numbers) and letters (examiner points to the letters). This time you are to draw a line from the number to the letter and then the number like this, (examiner uses his or her finger to trace over the following sequence of numbers and letters saying) 1 to the letter A, (pause), A to the number 2, (pause), 2 to the letter B (pause), B to the number 3, (pause), 3 to the letter C (pause), and so on. Now you do it using the pencil (do not let the child make an error). If the child is confused or does not understand the task, say: Let's do it together. Draw a line from 1 (examiner points to the number 1), to A (examiner points to the letter A,) then 2 (examiner points to the number 2,) then B (examiner points to the letter B), 3 (examiner points to the number 3), C (examiner points to the letter C), 4 (examiner points to the number 4), D (examiner points to the letter D). If the child is still confused, briefly explain the task and repeat the item using the same page.

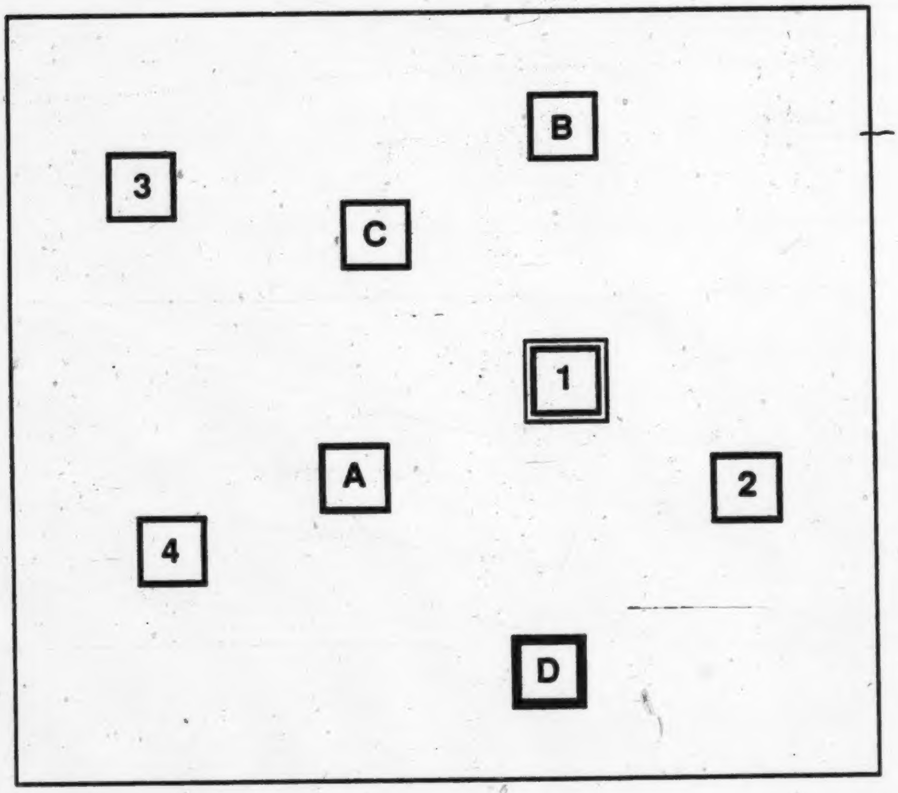
With the sample still exposed say: Now I'm going to give you some more of these to do. You should always start from the number one (examiner points to the number 1 in the double box in the Sample D) and draw a line from the number to the letter, then from the letter to the number, then from the number to the letter, and so on until you get to the last letter (Examiner points to the last letter). Work as quickly as you can without making a mistake. Do you understand? (If the child is confused, briefly explain the task and continue).

Items 9 and 10

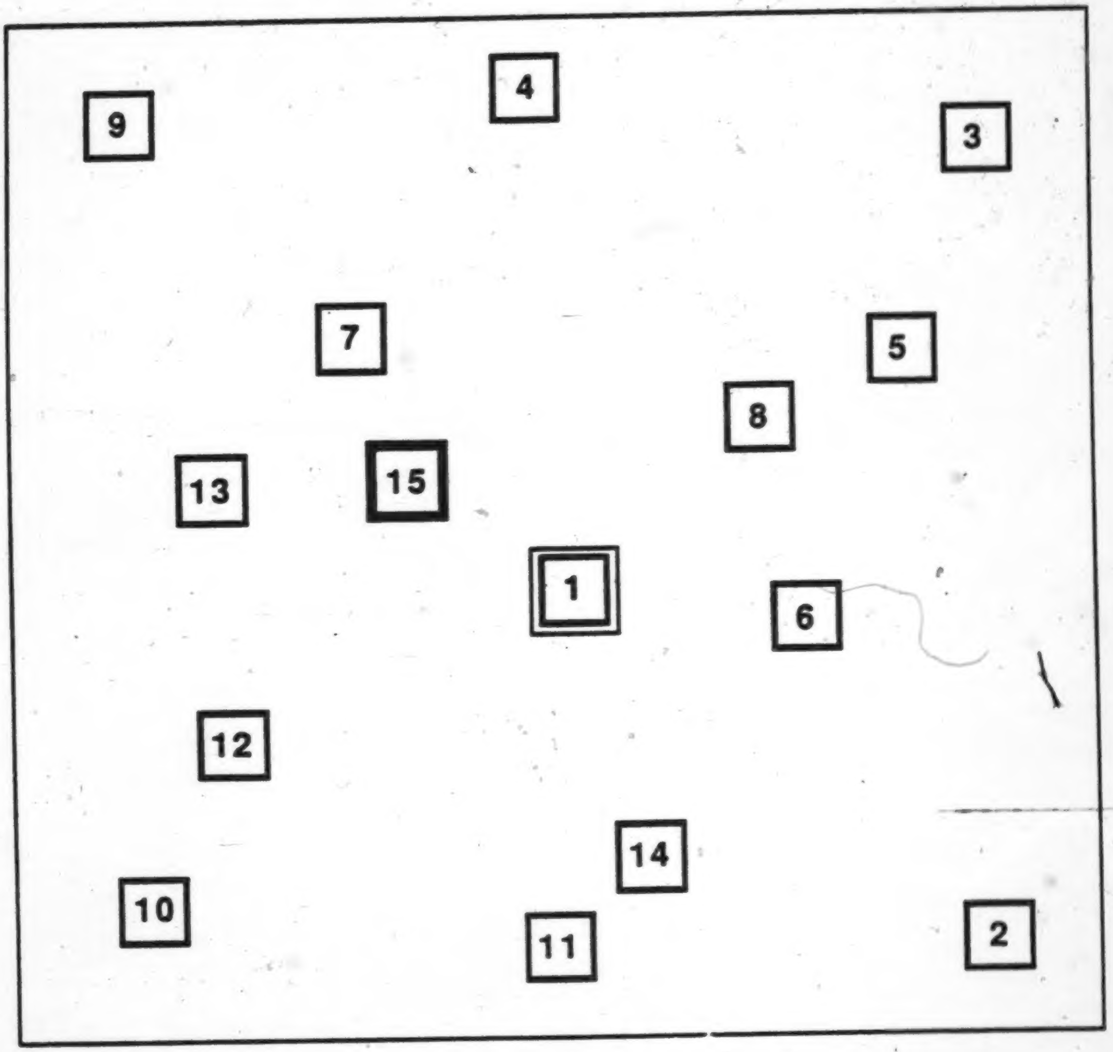
Now do this one (examiner exposes the item and begins timing). If the child makes an error during the task, the examiner should immediately say: Wait, you made a mistake, begin again from here (examiner points to the previous correct location. Do not stop timing). This instruction may be repeated as needed.

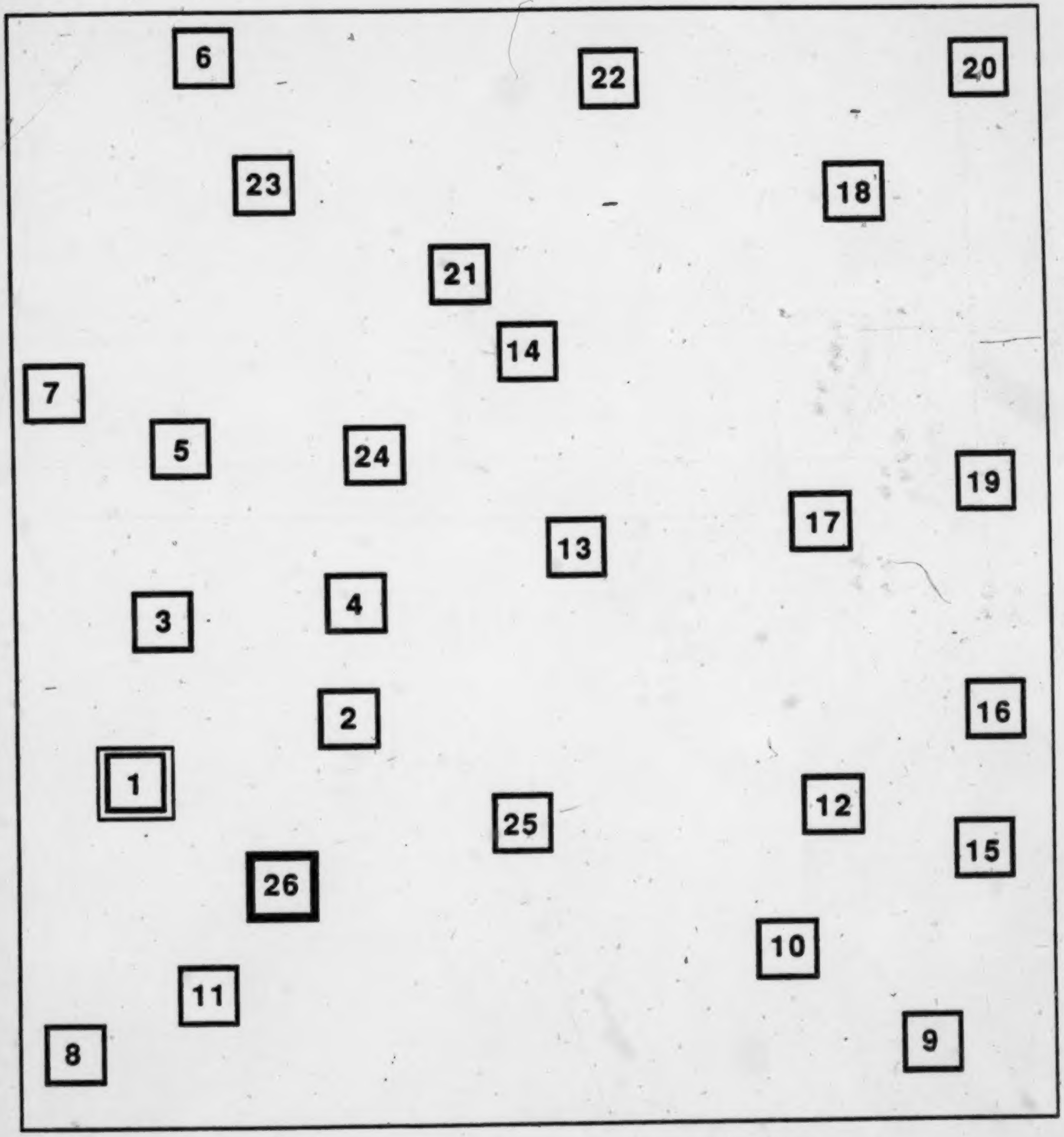


SAMPLE C

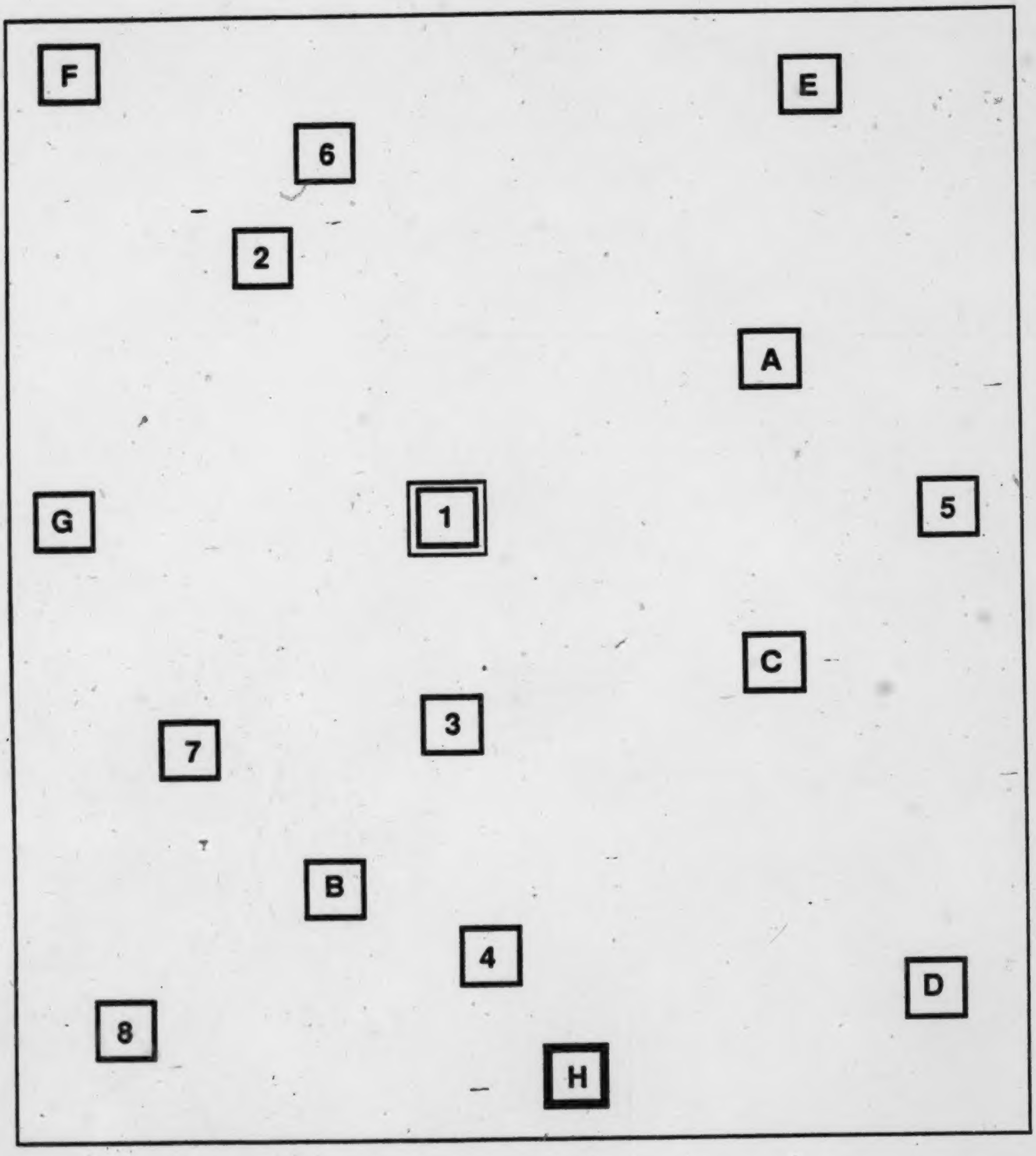


SAMPLE D

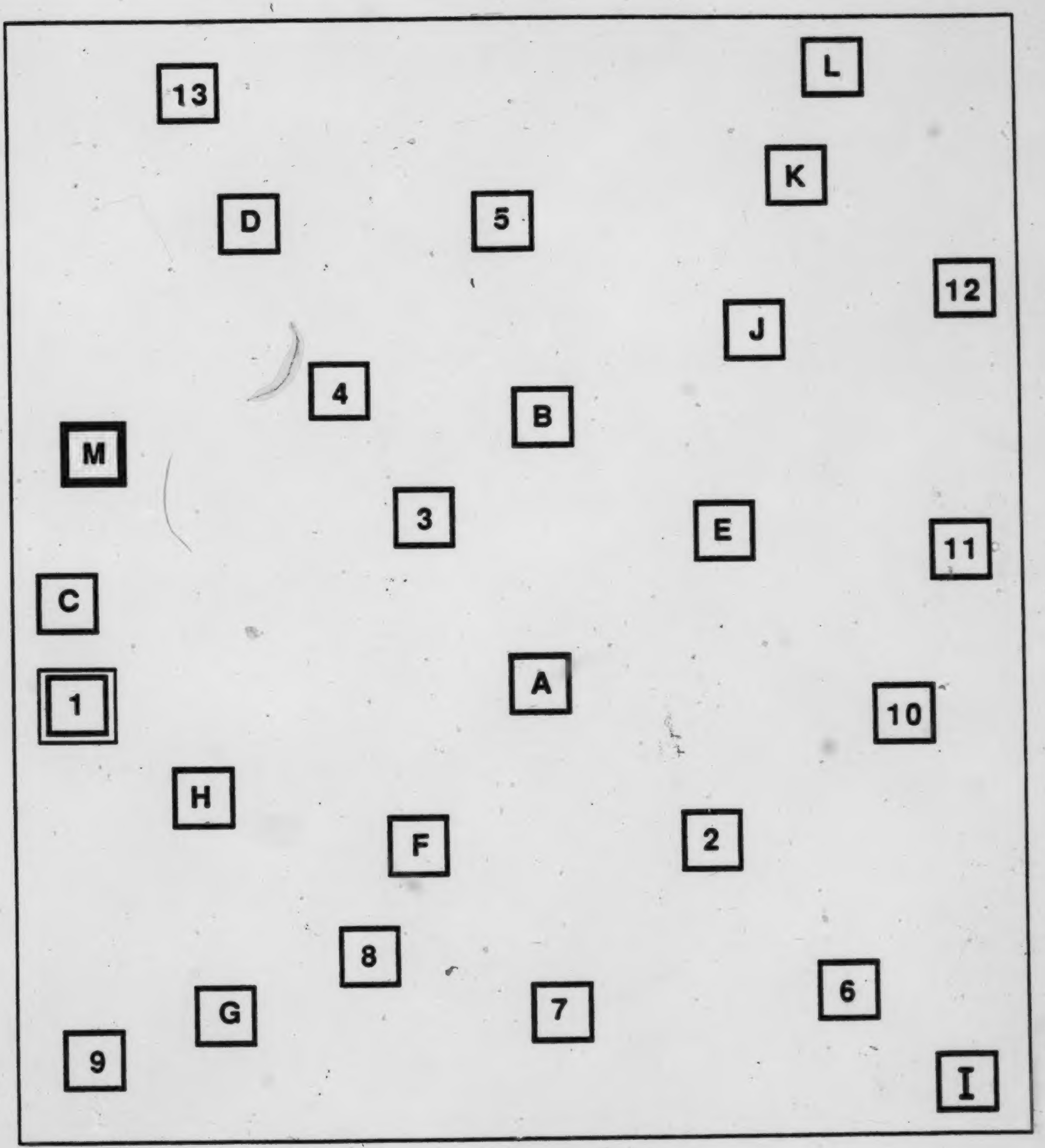



6
22
20
23
18
21
14
7
5
24
19
17
13
3
4
16
2
1
25
12
15
26
10
11
8
9

8


F
E
6
2
A
G
1
5
C
3
7
B
4
D
8
H

9


L
13
K
D
5
12
J
4
B
M
3
E
11
C
A
1
10
H
F
2
8
6
G
7
9
I

10

Subtest Crack The Code

Task Description:

In this planning subtest the student's task is to determine what the correct sequence of colored chips is when given a limited amount of information. The subject is given two or three trials to figure out the one correct order of chips for each of the 7 items. the subtest is organized into 7 items with 2 or 3 trials per item and a 3 minute limit per item. Do NOT administer to grades K-2.

Administration Guidelines:

1. Score the time it takes the student to produce each response per item.

2. Score each item as 1 or 0; score 1 if the correct answer is reached according to #3 below.

3. Give credit for each 3 color item if the item is solved in 2 trials or less, and credit for 4 color problems if solved in 3 trials or less.

4. Give feedback at the end of each Trial according to the number of chips in the correct locations.

5. Administer to grades 3 and above only.

6. The examiner may NOT explain why the answer is correct. If the child asks why, say; I'm not allowed to tell you why it is correct.

7. Discontinue after failure on two items (not two trials).

8. There is a maximum time limit of 3 minutes per item. If the child does not respond within the time limit, stop him saying: O.K. stop, let's try another one. Record the time as 3.01 and score the item as 0.

9. Any portion of the directions may be repeated if necessary for any item.

10. Administer all trials for each item.

Directions for Administration

Sample 1

Examiner says: Look at this. You see there is a black piece here and a a blue one here, but these pieces are not in the correct places. (Examiner points to the statement 'No colors are correct'). You are to figure out which piece goes where. Put these (examiner provides blue and black circular colored chips used to indicate the answer) here (Examiner points to the first row for Sample 1) in the correct order. Do you understand? If not, briefly explain the task again. (Examiner points to the response location). Ready? Begin. (Allow 60 Seconds)

If correct say: That's right, both of the colors are in the correct places, good. Administer Sample 2.

If incorrect say: That's not correct. These two colors are not in the right places. If we put the black one here (examiner points to the right space) and the blue one here (examiner points to the left space) then they are both correct. Do you understand? Explain briefly if needed (e.g. If these two were not in the correct places, then you put the black here and the blue here to make it right) then administer Sample 2.

Sample 2

Trial 1: Examiner puts out the chips on the page and says: Now look here. You see there are three circles here, but only one of these is in the correct place. (Examiner points to the statement 'one color is correct'.) You are to figure out which color goes where. Put these (examiner provides blue, black, and white circular colored chips used to indicate the answer) here (Examiner points to the appropriate row for Sample 1) in the correct order. I'll tell you how many of the colors you have in the right places but I can't tell you which colors are correct. Do you understand? If not, briefly explain the task again. (Examiner points to the response location). Ready? Begin. (Allow 60 seconds).

If correct say: That's right, all of the colors are in the correct places, good. Administer Sample 2.

If incorrect say: ___ of the colors are in the right places (the examiner records the number correct on the response page). Explain briefly if needed.

Trial 2: Administer second trial (using three more chips and leaving the previous response intact) saying: Now try again to figure out the answer.

If correct say: That's right, all of the colors are in the correct places, good. Examiner records the number correct and administers Item 1.

If incorrect say: ___ of the colors are in the right places (the examiner records the number correct on the response page). The answer is this, black-white-blue (examiner arranges the pieces accordingly and allows the child to inspect the correct answer. Do not explain why the answer is correct). Now let's try another one.

Items

The examiner puts the chips in the proper sequence on the response page and says: None of these colors is in the correct place (examiner points to the first line for the item). Put these (examiner only gives the subject the correct number, 3 or 4, and the colors needed) here (examiner points to the appropriate row), in the correct order. When the subject has responded the examiner scores and records the number of chips in the correct location and says:

If correct: Good, and then gives the next item.

If incorrect: The examiner says and writes on the response form: ___ are correct. Then leaving the child's response intact, the examiner provides four more pieces (one of each color) and says: Now try again (if not the last trial) or now try another one (if no more trials are indicated).

Note: If the child does not complete the item (all trials) within the time limit, stop him/her saying O.K. stop, let's try another one. Record the time as 3.01 and score the item as 0.

black

blue

None correct

___ correct

SAMPLE 1

white black blue

None correct

___ correct

___ correct

SAMPLE 2

blue white black

None correct

___ correct

___ correct

blue black white

None correct

___ correct

___ correct

blue white black

None correct

___ correct

___ correct

yellow white black blue

None correct

____ correct

____ correct

____ correct

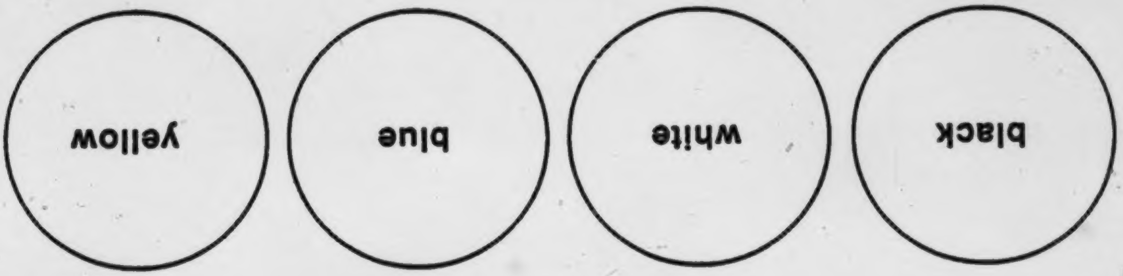
white blue black yellow

None correct

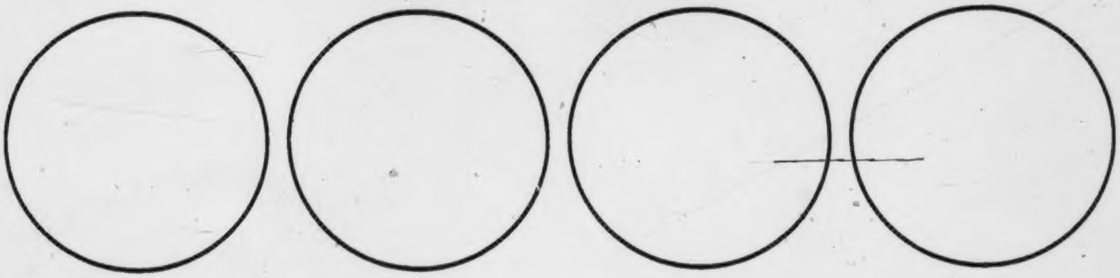
____ correct

____ correct

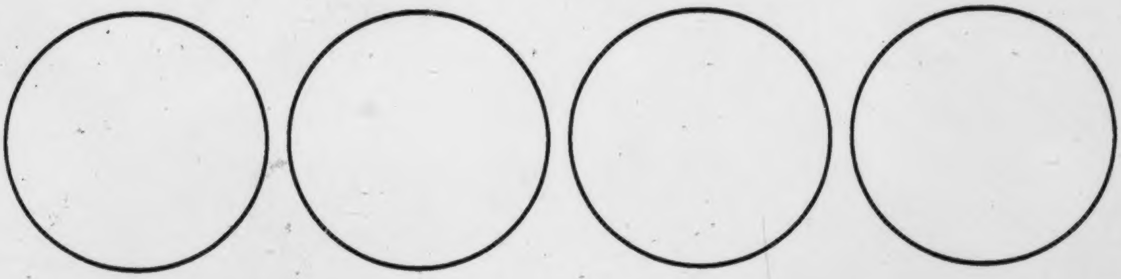
____ correct


yellow
blue
white
black

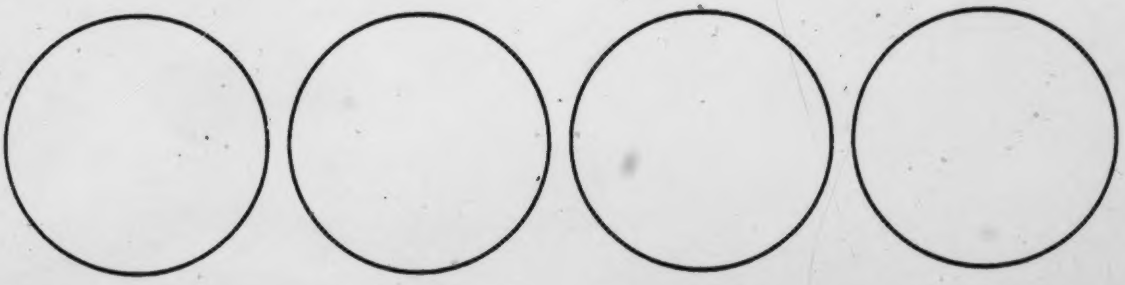
None correct



____ correct



____ correct



____ correct

white yellow blue black

None correct

____ correct

____ correct

____ correct

Subtest Crack the Code

Time limit is 3 minutes per item. Discontinue after 2 consecutive items are scored 0. Administer to grades 3 and above only.

Record the subject's responses (from child's left to right).

Item	Answer (child's left to right)	time (min=sec)	score (1-0)
Sample 1	Blue-Black		
trial 1	____-____	____=____	_____
Sample 2	Black-White-Blue		
trial 1	_____-_____-____	____=____	_____
trial 2	_____-_____-____	____=____	_____
Item 1	Black-Blue-White		
trial 1	_____-____-_____	____=____	_____
trial 2	_____-____-_____	____=____	_____
Item 2	Blue-White-Black		
trial 1	____-_____-_____	____=____	_____
trial 2	____-_____-_____	____=____	_____
Item 3	White-Black-Blue		
trial 1	_____-_____-____	____=____	_____
trial 2	_____-_____-____	____=____	_____

Subtest Crack the Code

Item	Answer (child's left to right)	time (min=sec)	score (1-0)
Item 4	White-Yellow-Blue-Black		
trial 1	_____-______-____-_____	____=____	_____
trial 2	_____-______-____-_____	____=____	_____
trial 3	_____-______-____-_____	____=____	_____
Item 5	Black-Yellow-White-Blue		
trial 1	_____ ______-_____-____	____=____	_____
trial 2	_____-______-_____-____	____=____	_____
trial 3	_____-______-_____-____	____=____	_____
Item 6	Blue-White-Black-Yellow		
trial 1	____-_____-_____-______	____=____	_____
trial 2	____-_____-_____-______	____=____	_____
trial 3	____-_____-_____-______	____=____	_____
Item 7	Black-Blue-Yellow-White		
trial 1	_____-____-______-_____	____=____	_____
trial 2	_____-____-______-_____	____=____	_____
trial 3	_____-____-______-_____	____=____	_____

Examiner's Comments:

Subtest Visual Search

Task Description:

The child's task in this planning subtest is to find an object, number or letter located in a box in the center (called the Target) of the group of objects (called the Field). The examiner presents the item (on one page) which contains 2 searches, and times the child's from the moment the page is exposed (or turned) until the child points to the second object on that page. That is, the child's score is the time it takes to find the two Targets which comprise the item, from the moment the page is exposed until the time the child is finished with the item (both Targets found within the Field). Administer all items in all cases.

Administration Guidelines:

1. If the child points to the wrong object in the Field, immediately say: That's not it, keep looking. Repeat the statement as needed.

2. Begin timing at the moment the page is exposed to the child and stop timing when the child points to the second Target of each item.

3. There is a 90 second time limit per item.

4. If the child stops after completing the top or bottom search only, say: Now do this one (point to the Target).

5. The child may solve each item by finding the Target in the lower or upper portion of the page first.

Directions for Administration

Sample

The examiner begins by saying: Look at this page (examiner points to the upper portion of the Sample page). Point to another one just like this one (examiner points to the Target in the center of the top Field), somewhere here (examiner points to the upper field) in one sweeping circular motion beginning and ending at the top of the Field.

If correct, say: Good. Then continue with the directios for the Sample page.

If incorrect, say: Here it is (examiner points to the face). Then continue with the directions for the Sample page.

Now look here (examiner points to the Sample page, lower half). Point to another one just like this (examiner points to the Target - the box located in the center of the Field), somewhere here (examiner points to the Field - the objects on the lower Field around the Target in one sweeping circular motion beginning and ending at the top of the Field).

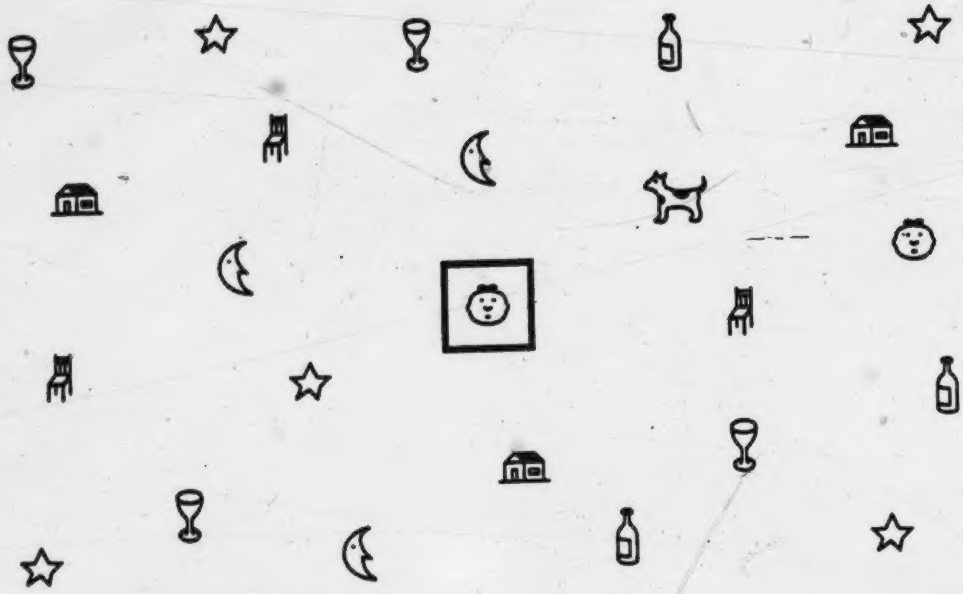
If correct, say: Good. Then continue with item 1.

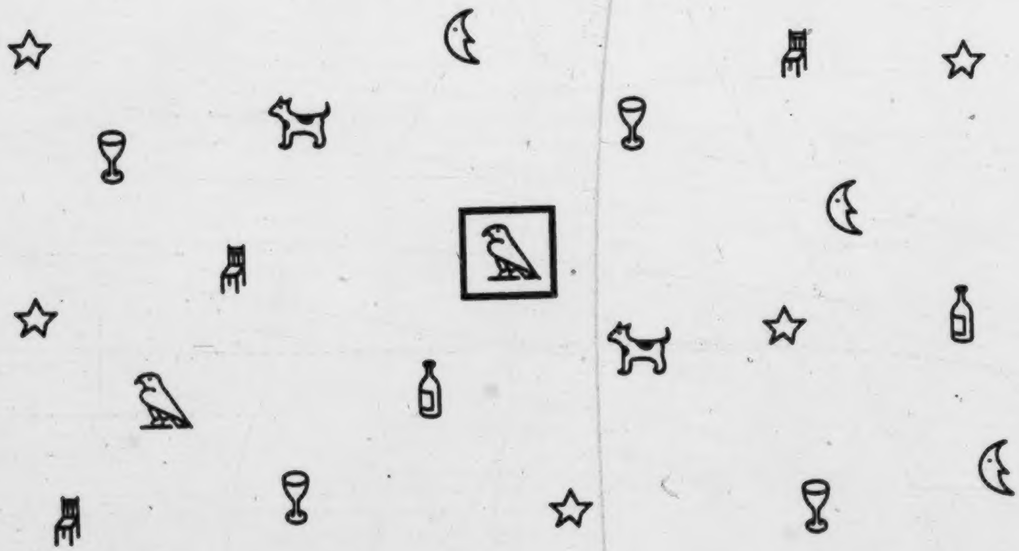
If incorrect, say: Here it is (examiner points to the bird). then continue with item 1.

The examiner then says with the Sample item still exposed: I'll show you some more pictures like these, and each time you are to find what is here (examiner points to the box located in the center of the top Field), somewhere here (examiner points to the Field on the top portion of the page in one sweeping circular motion beginning and ending at the top of the Field). Then find this one (examiner points to the Target on the lower portion of the page), here (examiner points to the lower Field). Try to work as quickly as you can. Do you understand? If the child does not understand use the sample item to illustrate and briefly explain the task, then proceed.

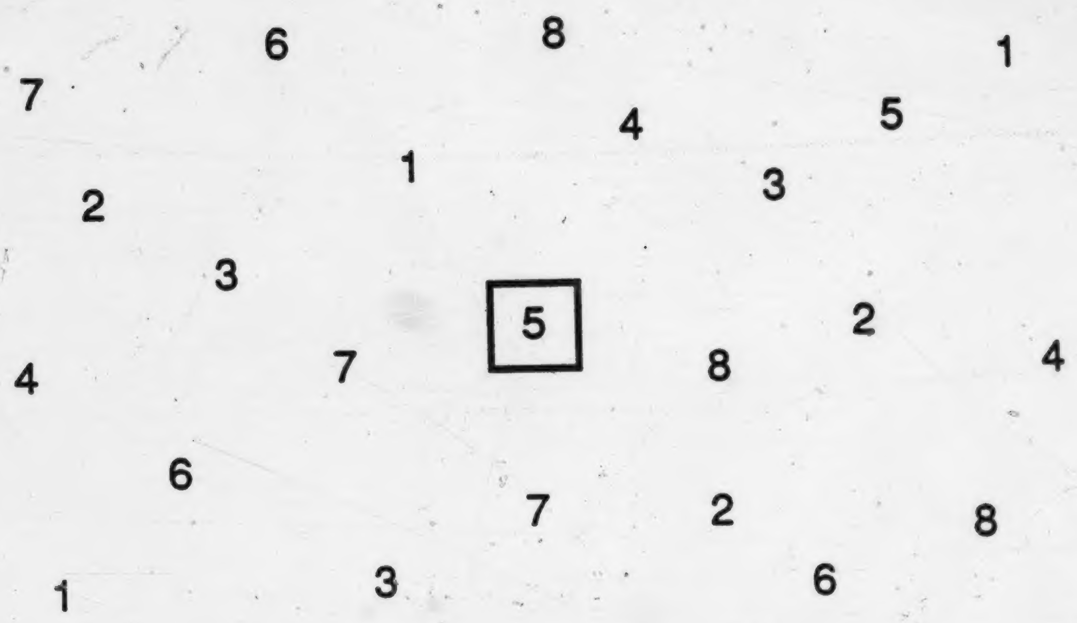
Be sure to begin as soon as I turn the page, find this (examiner points to the upper Target) here (examiner points to the Field for the top of the page) and this (examiner points to the lower Target) here (examiner points to the Field for the bottom of the page). Examiner turns the page and begins timing when the page is before the child.

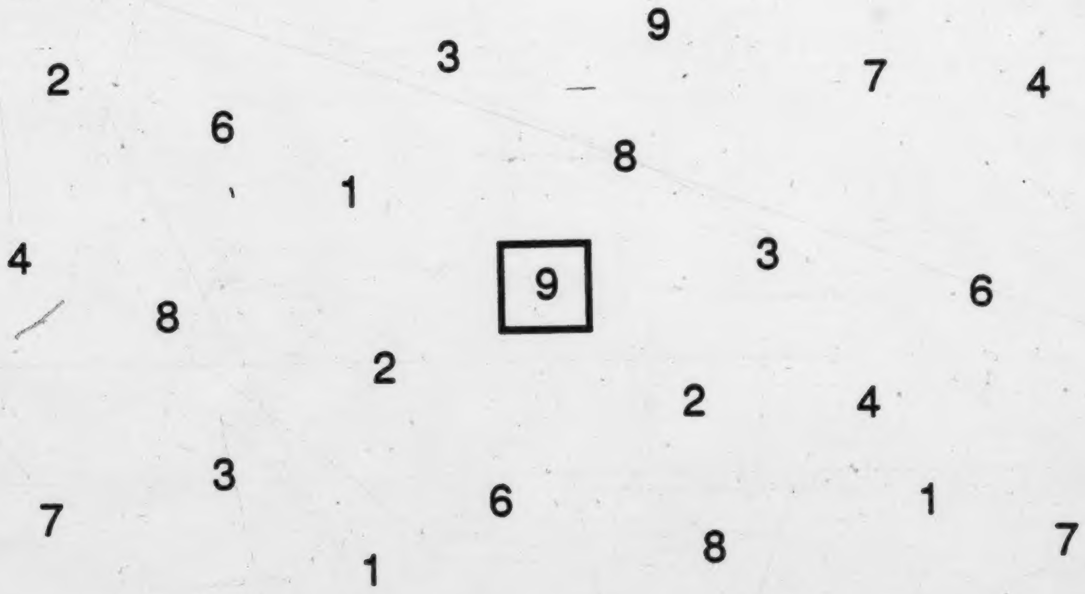
Administer the items saying: Now do this one (if necessary). If the child hesitates say: Find this (examiner points to the upper Target), here (examiner points to the upper Field) and this (examiner points to the lower Target), here (examiner points to the lower Field). Use these directions as needed throughout the subtest.





SAMPLE 1


6
8
1
7
4
5
1
3
2
3
5
2
4
7
8
4
6
7
2
8
1
3
6


9
3
7
2
4
6
8
1
4
3
9
6
8
2
2
4
3
6
1
7
7
1
8

SAMPLE 2

W V E Y Q

D G O I

X Z

N

L $\boxed{E}$ P B

U K

A R

F T S

M H J

Q M

V H

B Y

S C T

J N

P F

$\boxed{C}$

G

A L K

W

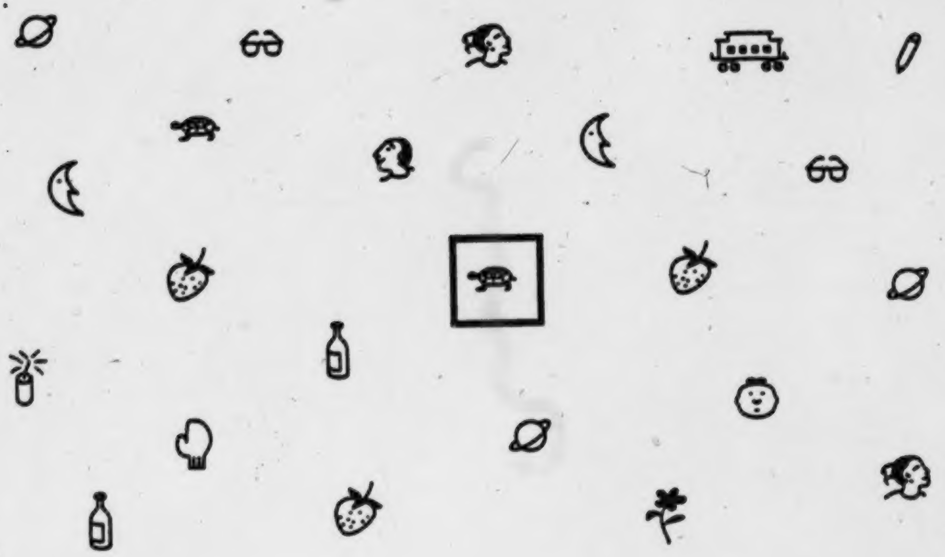
X

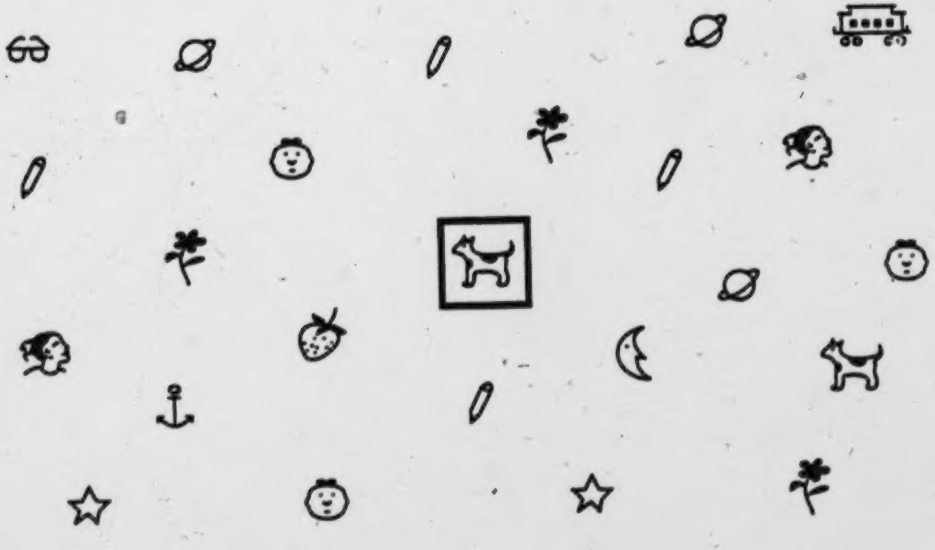
O D

R

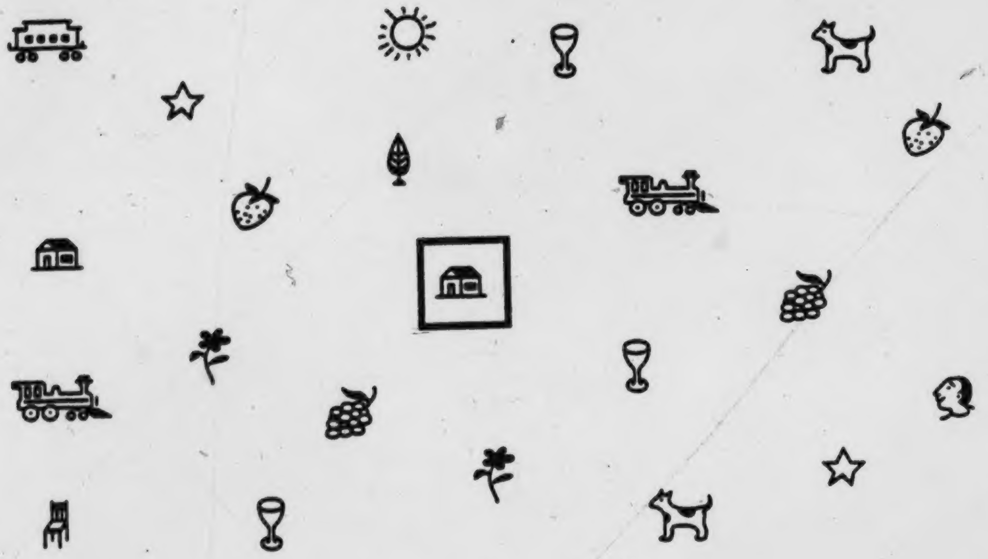
U Z I

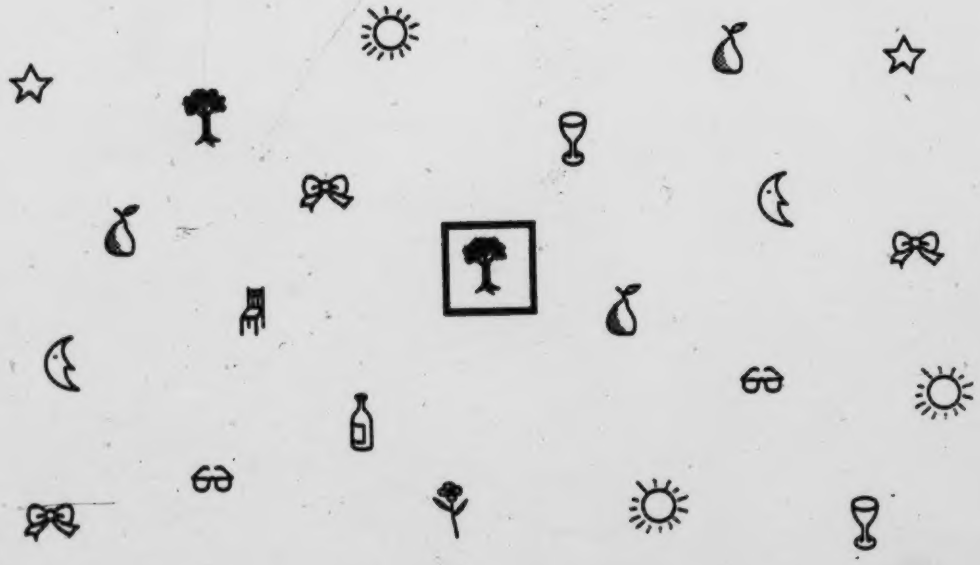
SAMPLE 3

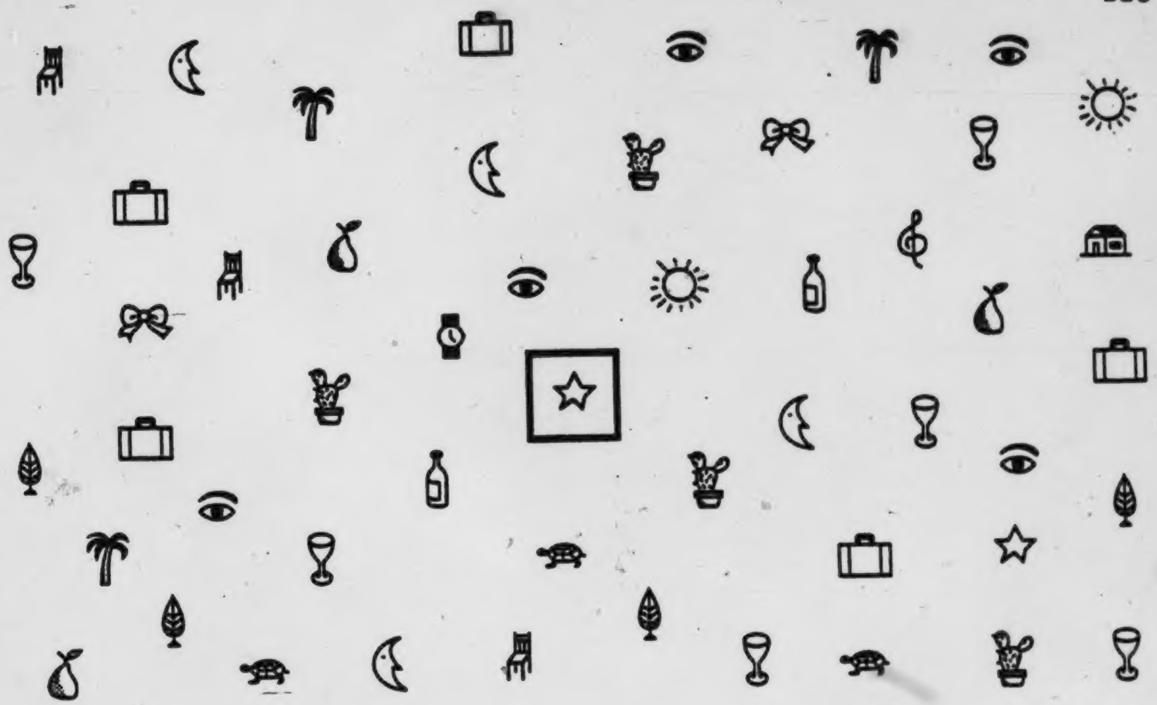


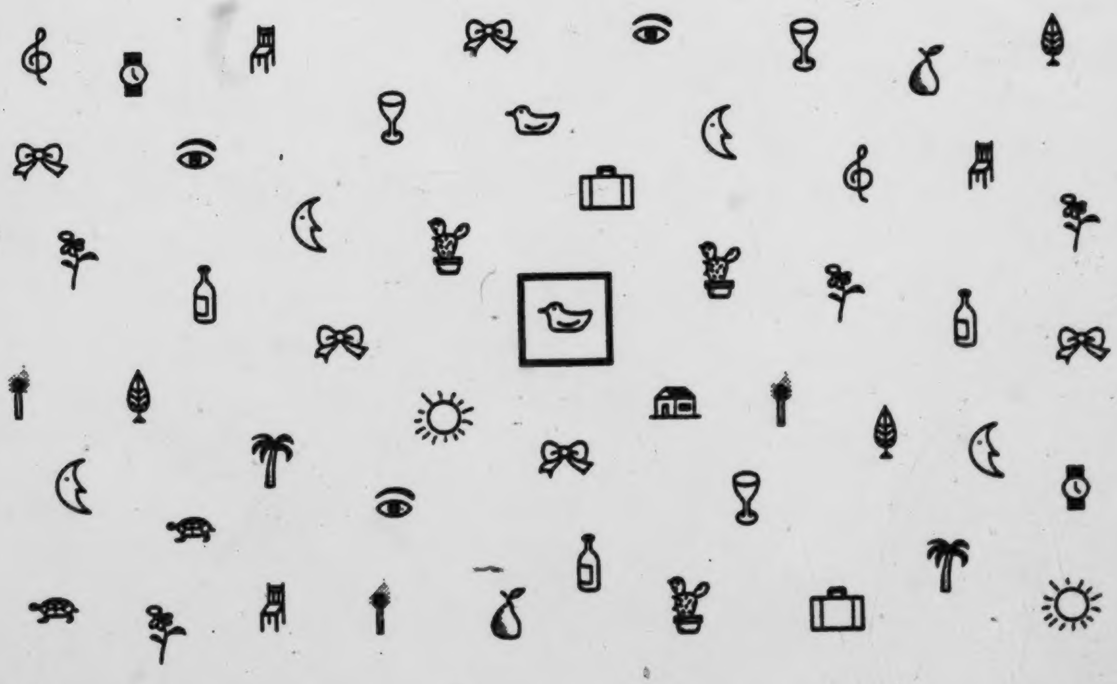


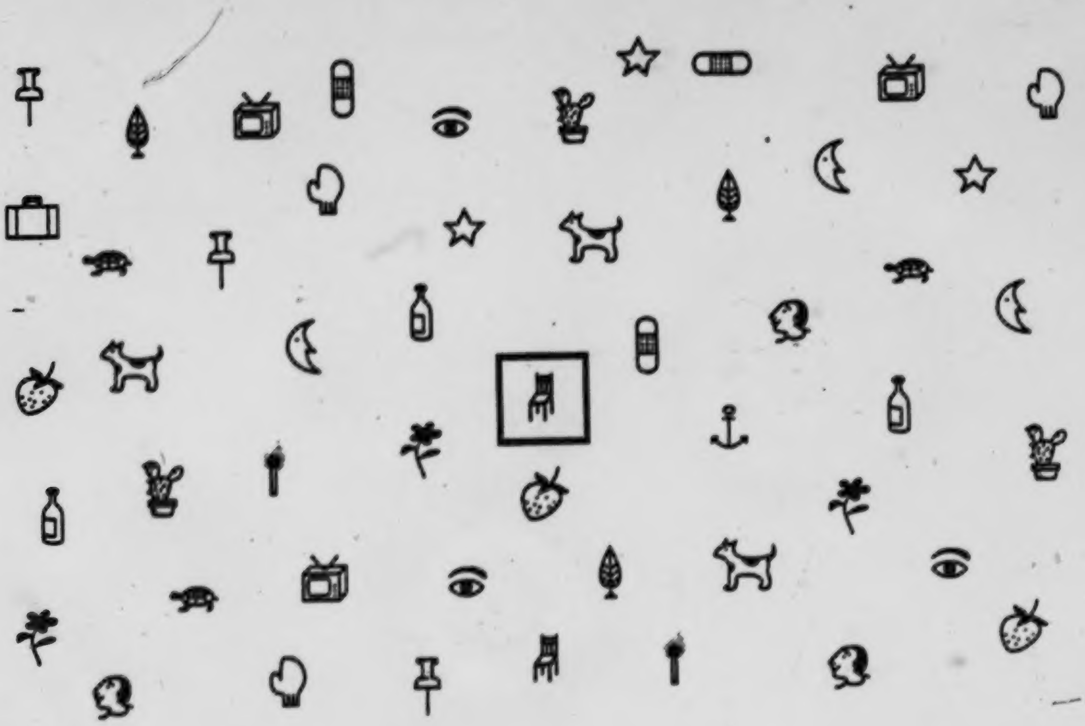
1

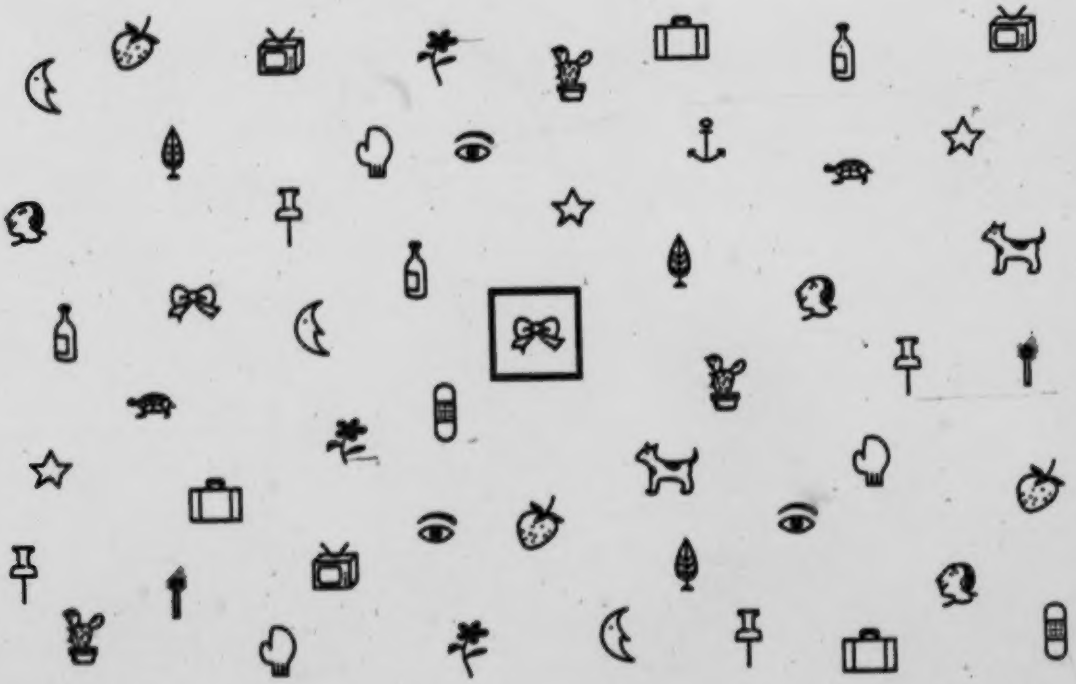












4

4 2 7 5

1 8 2

9 4

7 9

3 $\boxed{1}$ 3

8 7

8 5

2

5 3 9 4

---

5 4 4 8

9

3 8

6 2 3

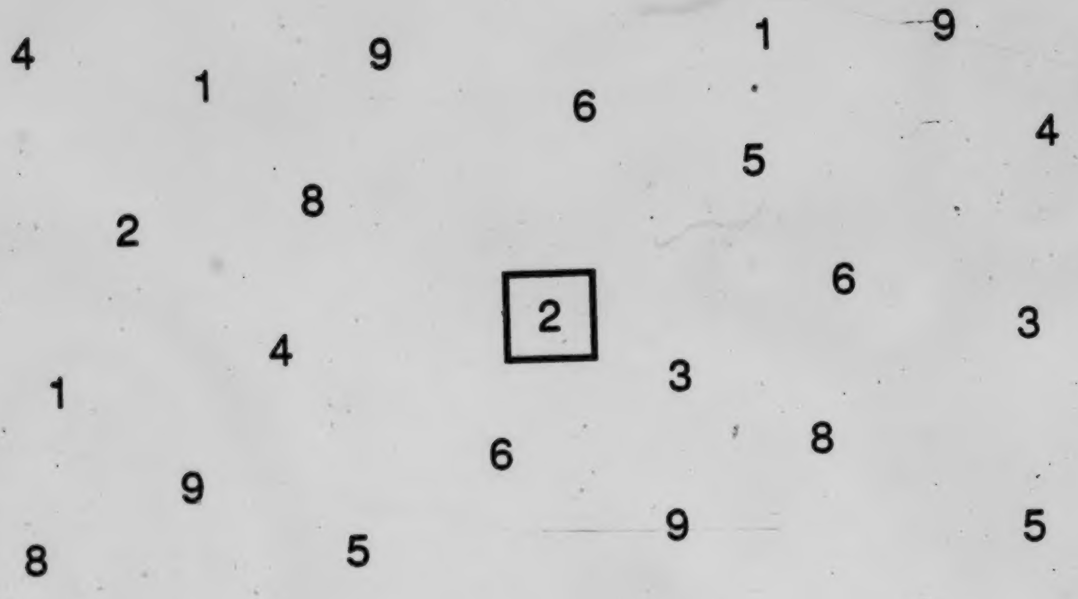
8 $\boxed{6}$ 7 2

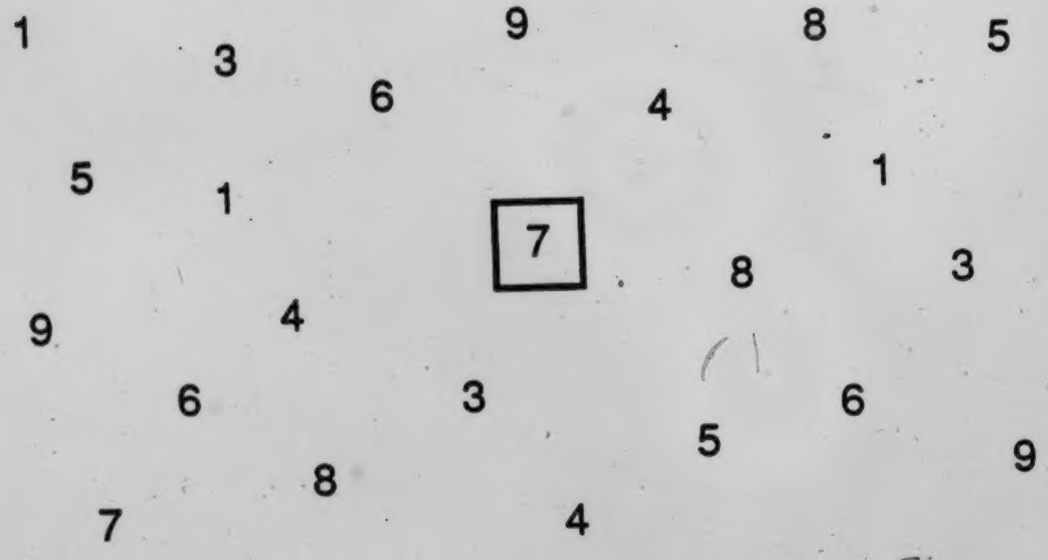
5 5

7 3 9

4 2 9

7





3 8 6 7 9 7 6 1

8 4 1 4 2 8

9 8 3 6 7 3 4 8 6

7 1 4 $\boxed{2}$ 1 4 3

6 4 3 4 8 1 6

9 7 9 9 9

3 1 3 7

7 6 8 1 9

---

3 8 8 9 1 9 7

9 6 3 7 6 1

6 4 1 4 6 1 4

9 3 3 8

4 8 7 9 $\boxed{5}$ 7 9

6 4 1 3 4 7

1 4 1 9 5 3

8 6 8 6 7 3 8

7

7 3 9 1 6 7 1 9

3 8 7 2 5 2 3 2 6

9

1 3 5 5 9 1

2 6 $\boxed{8}$ 6 5

5 6 1 3 7 3

7 3 6 5

1 5 1 7 9 1

2 9 7 2 9 6 2

---

5 5 1 7 3 7 5

1 9 7

6 3 6 6 2 1 9 3

2 5 7 3 9

9 3 $\boxed{4}$ 7 1 6 4

6 2 6 5 3 9 2

5 2

1 5

3 1

2 9 7 9 1 7 2 9 6

U T H D

J E O Y R

S K

W

L $\boxed{A}$ F

P G B

Q

A

M

I X C V

Z

D M U G O

N Q P I V

L E $\boxed{N}$ C Z

W K R Y

F H

B S X J T

D T I

M R

X H C

Q G

E $\boxed{\text{F}}$ Z N

W A P

S F

O Y

K L B U

V

K P E T R

X

V Q Z

L B D

$\boxed{\text{J}}$ O S

U W

G C A H

J

M Y I N

H G W M Q H C M
A T B X D F U R L
R V Z S V J D
G $\boxed{U}$ W I T
O E K N E Q Y
L A X F K S Z
K B I Y O C J N

A L O K X K T R
M O V E V C S A
N Y H J P Q
F I E S T $\boxed{P}$ Z H W
Z Q B I W J B L M
X F G N R D G C D Y

Q V C J W D B R

U E T P X A O V L

D H N K C W

Z K M Z

I X A G I T

P J O Y U

E M F N H

L R Y G B Q F

K Z J P C N X

O F U

Q T T A G W

F J N

B L W

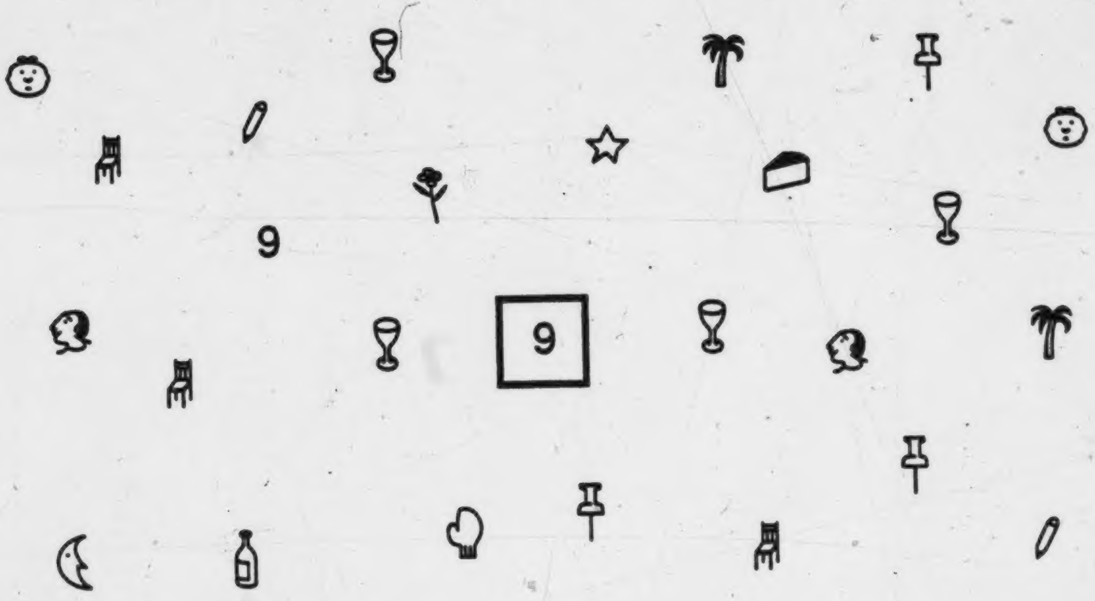
X S Y A

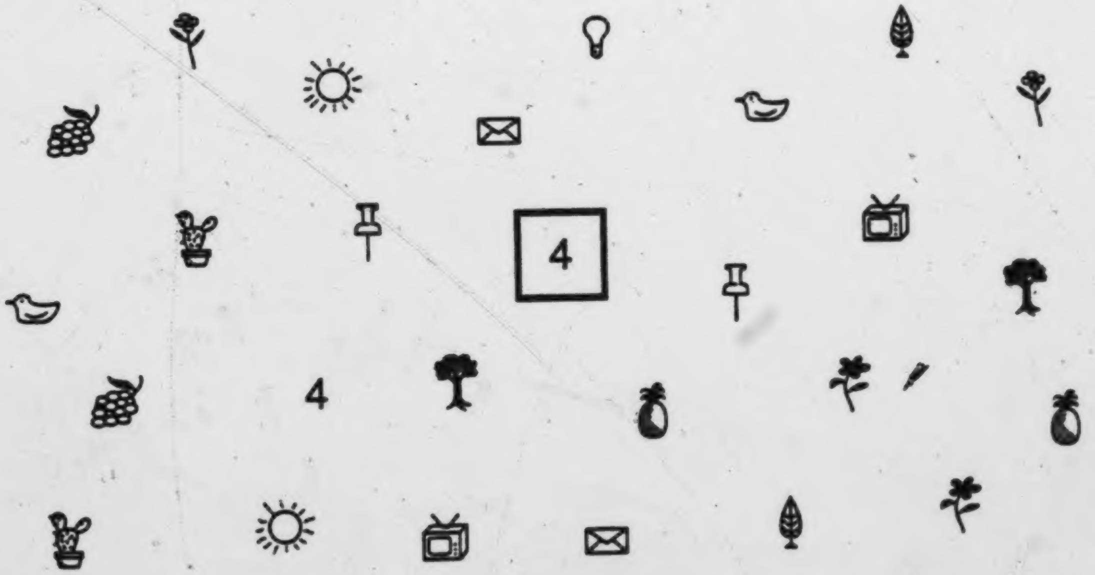
H H V I

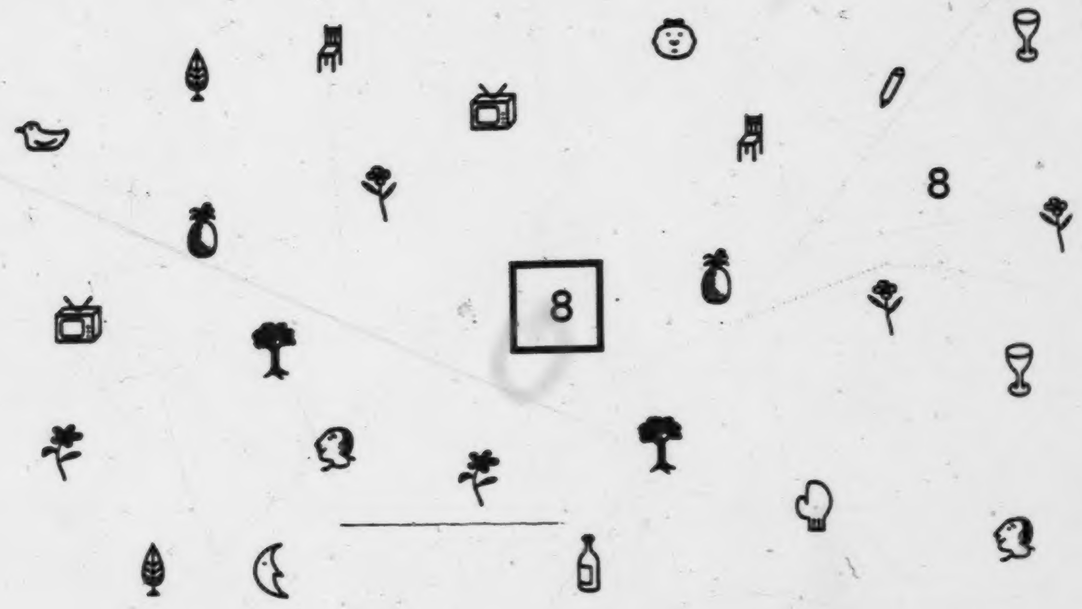
U Z P I K R V Y

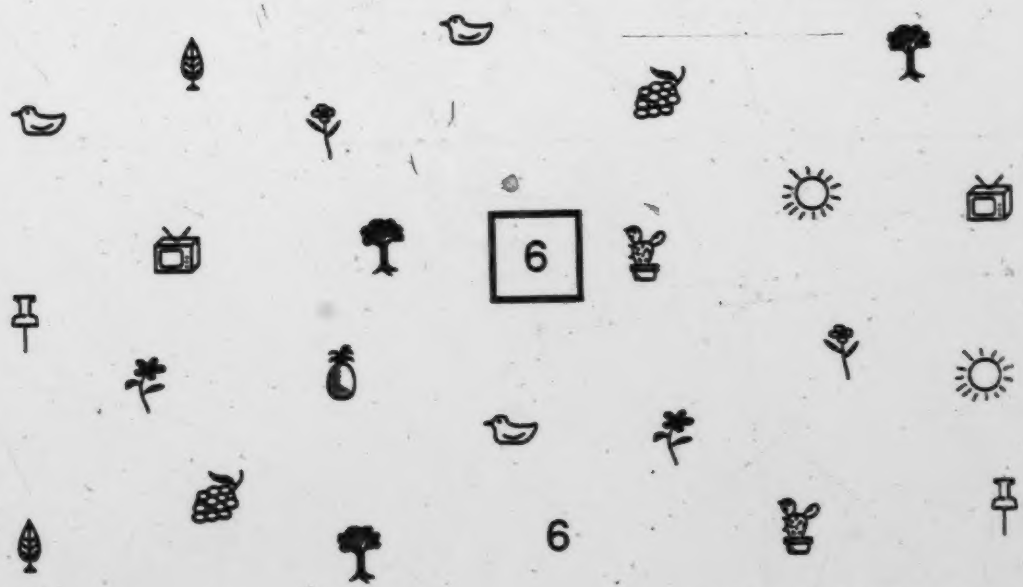
G S D D L

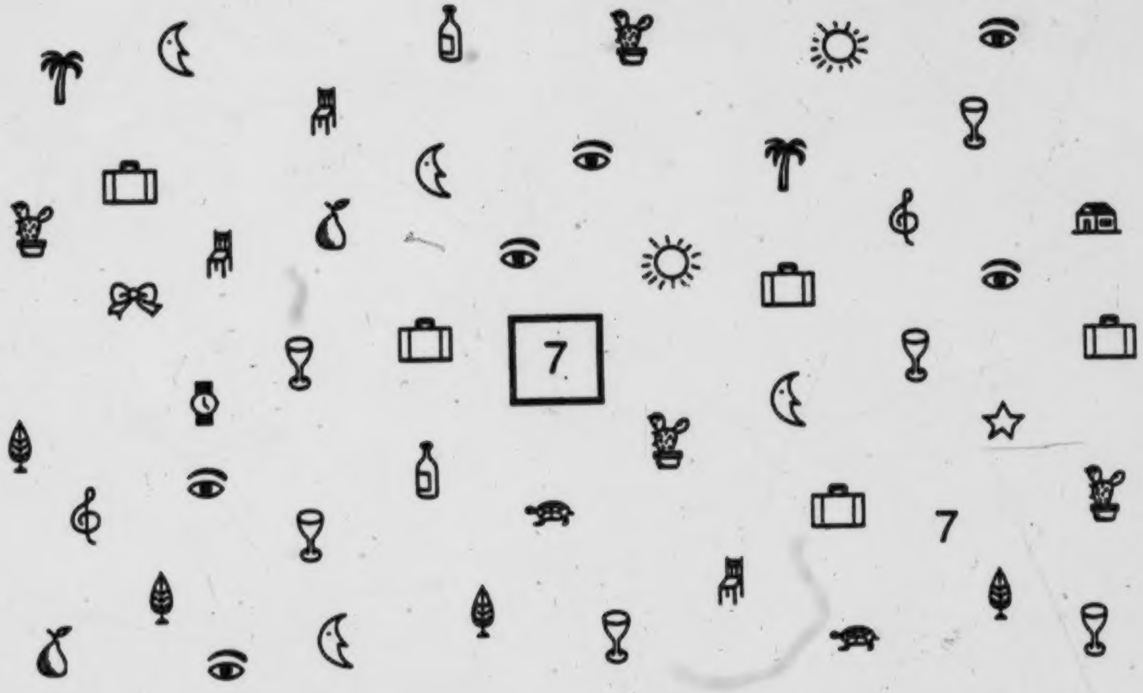
R E E C O B

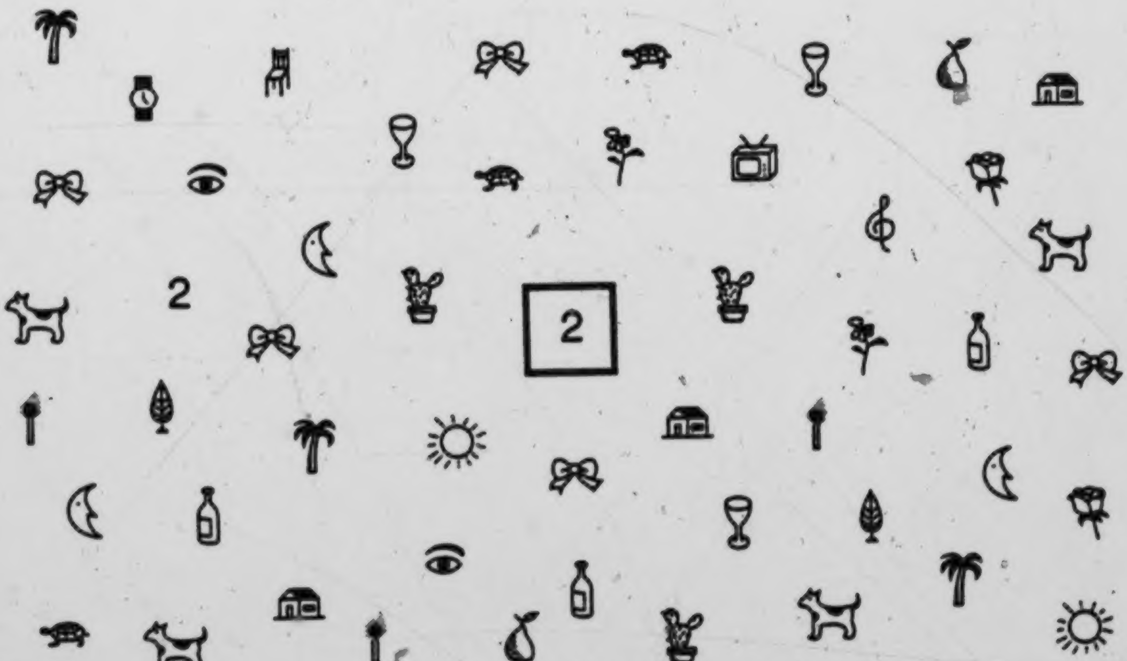

9
9

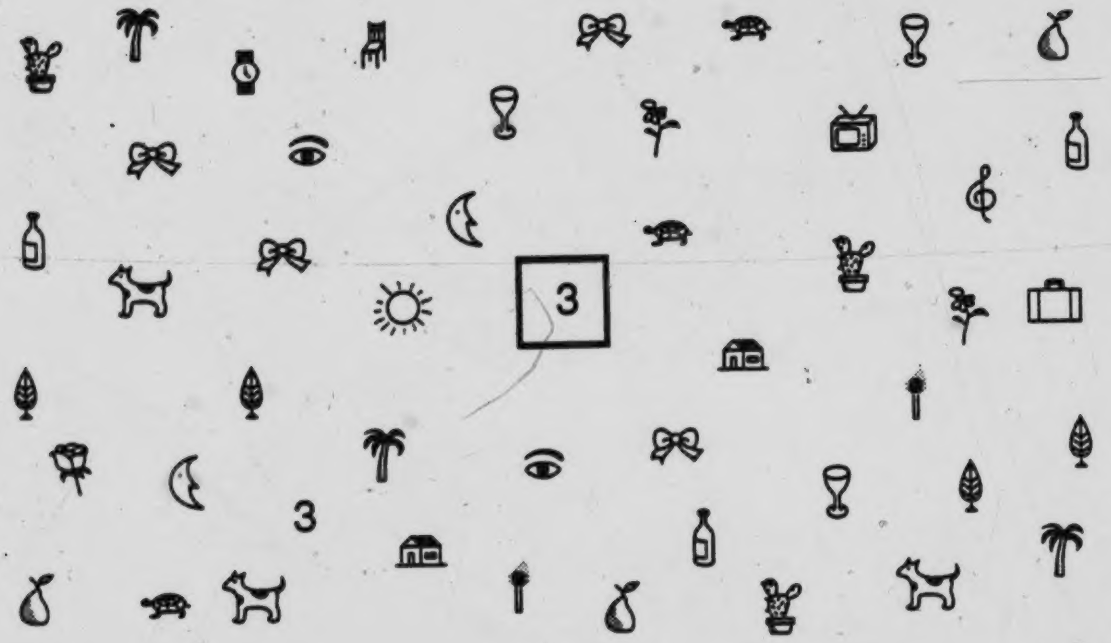

4
4

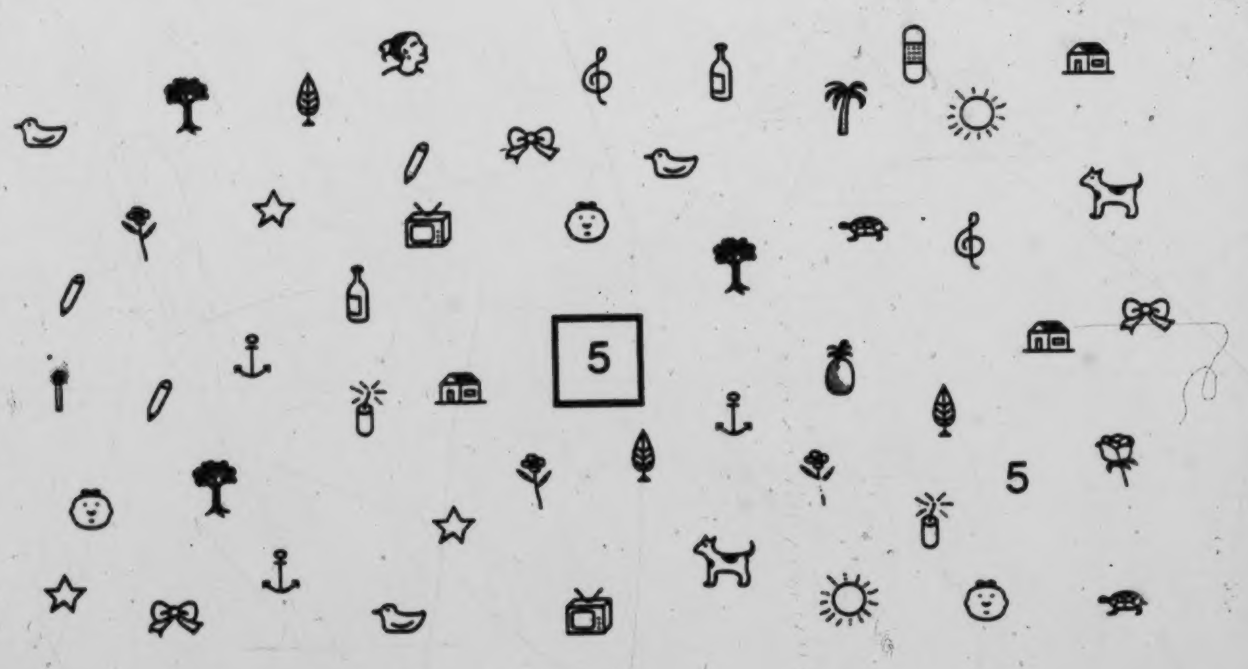

8
8

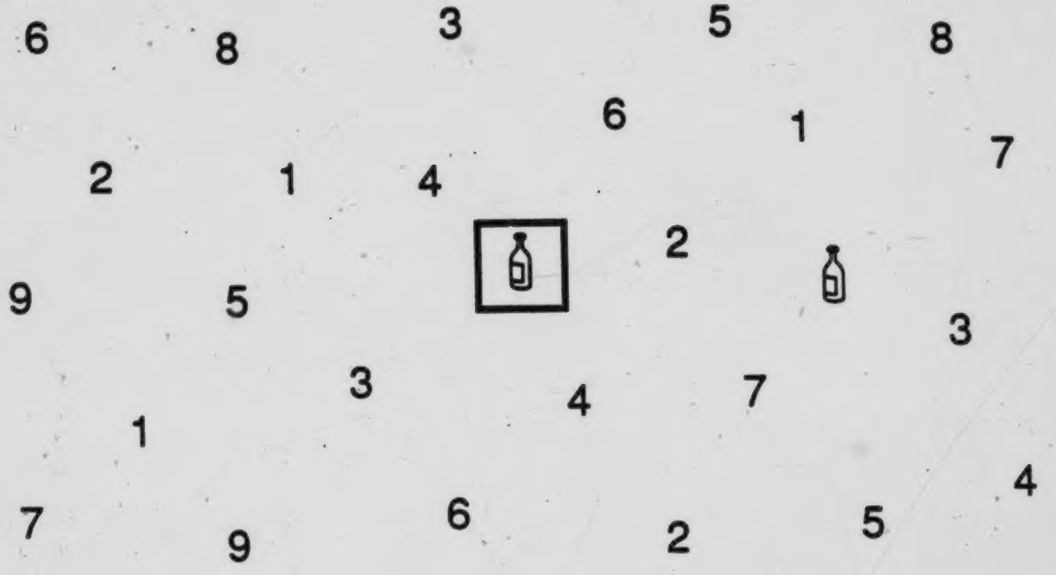

6
6

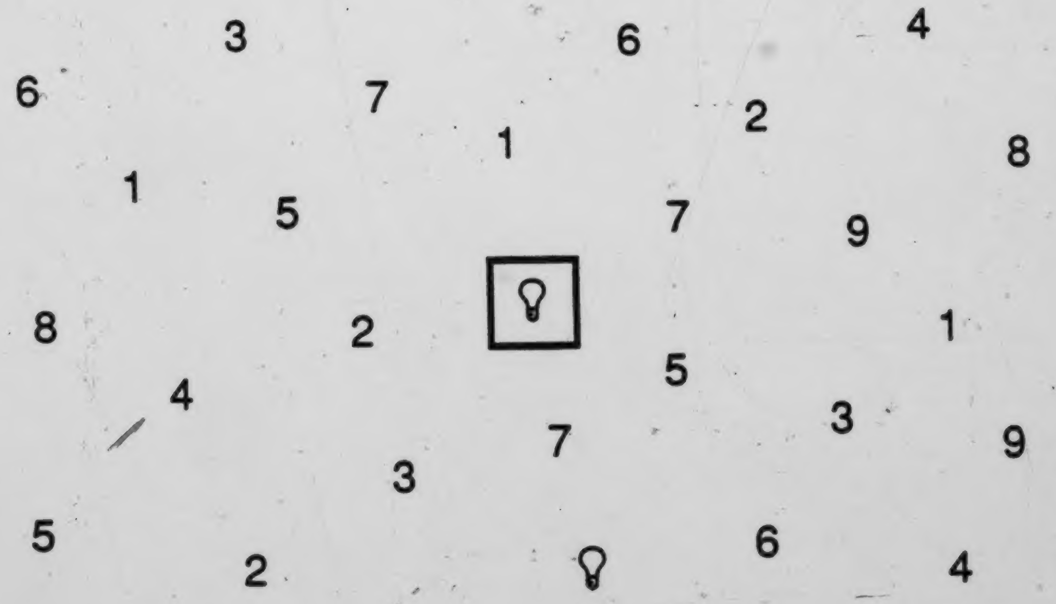

7
7

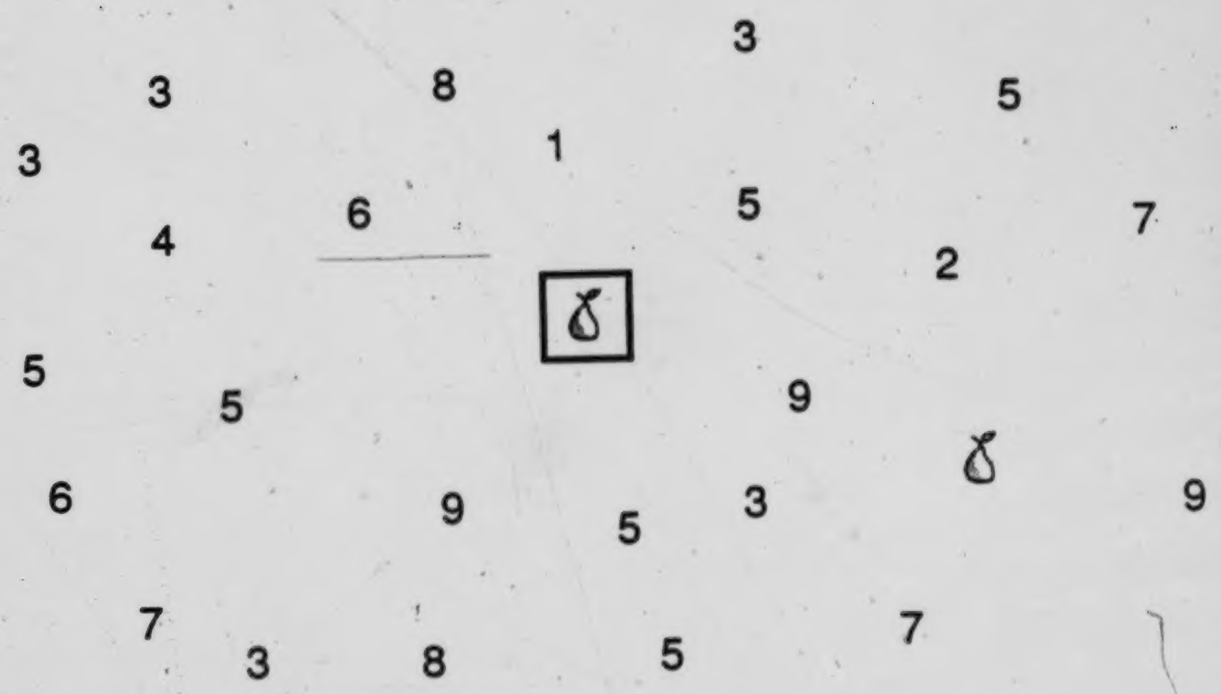

2
2

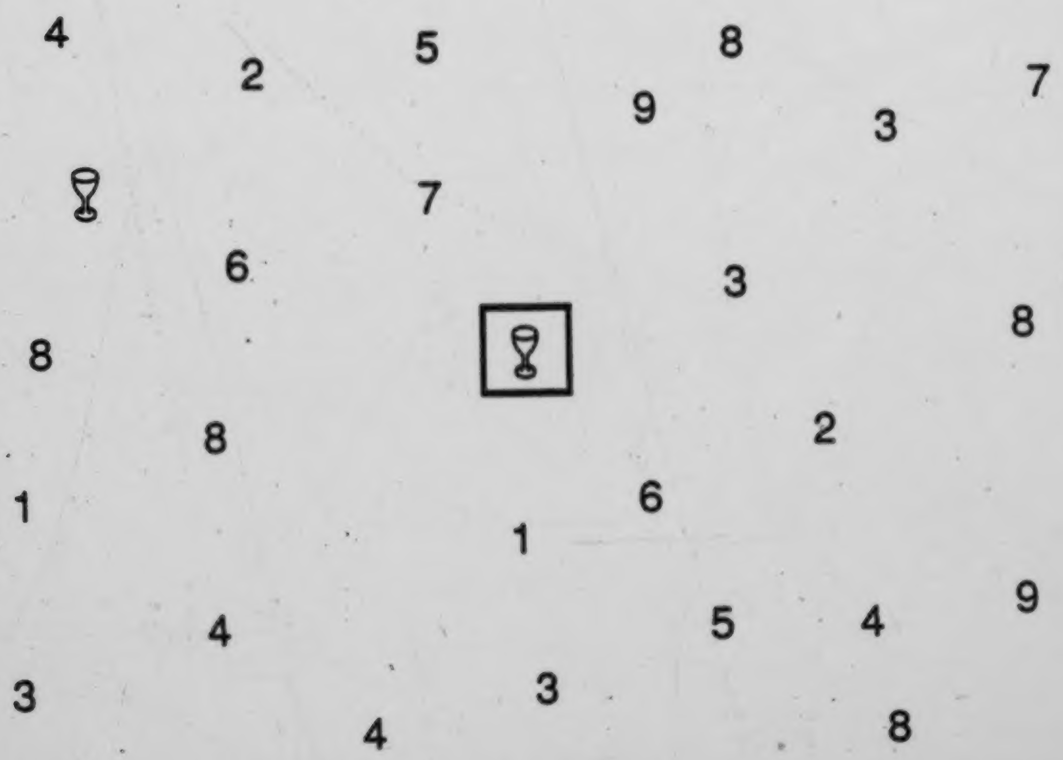

3
3


5
5


6 8 3 5 8
6 1 7
2 1 4
2
9 5 3
3 4 7
1
4
7 9 6 2 5


3 6 4
6 7 2
1 8
1 5 7 9
8 2 1
5
4 3 9
7
3
5 2 6 4

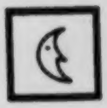




1 7 4 6 3 7 4 3

3 5 9 2

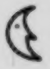
9 1 8

9 2 

4 2 5

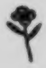
5 7

2 3 1 1

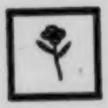
4 6 8  6 8

---

8 1 7 3 7 1

2 

7 4 9 6 9

4  5

2

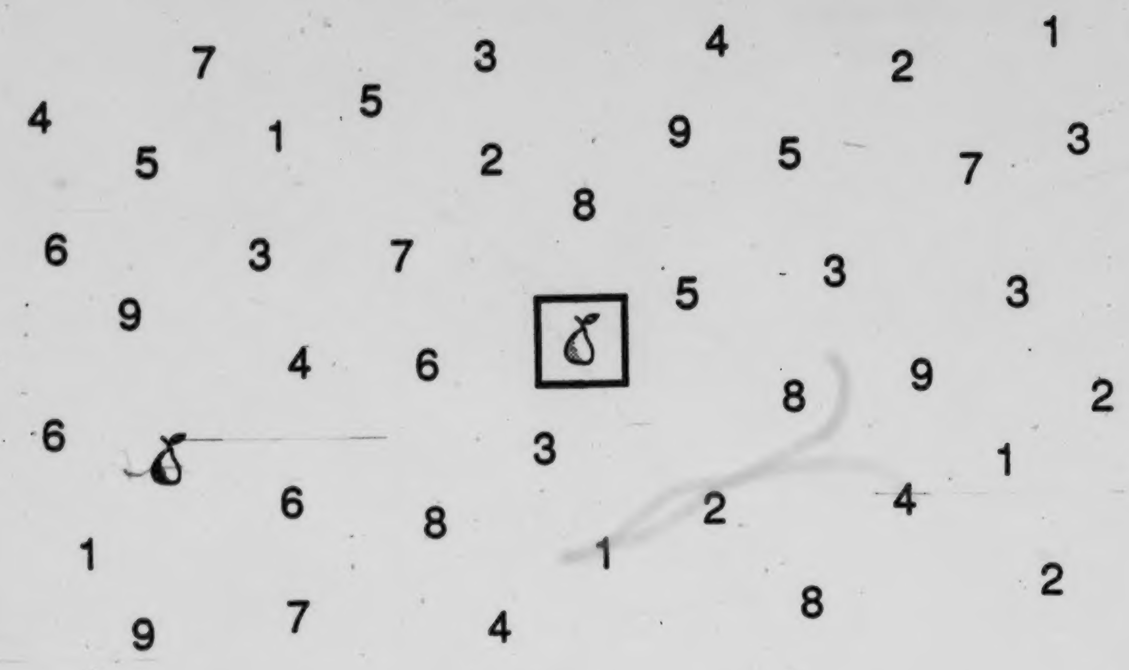
1 2 2

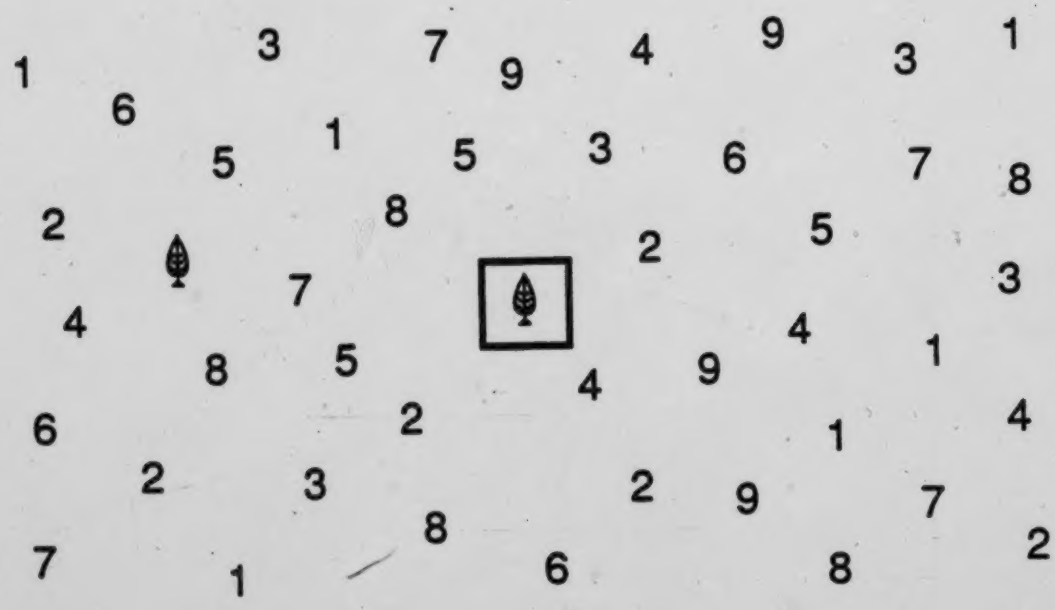
5 4

4 8 6 3

9 1 6

3 5 3 8


7 3 4 2 1
4 5 1 5 2 9 5 7 3
6 3 7 8 5 3 3
9 4 6 8 9 2
6 3 1
6 8 2 4
1 1 2
9 7 4 8


1 3 7 9 4 9 3 1
6 5 1 5 3 6 7 8
2 8 2 5
7 3
4 8 5 4 9 4 1
6 2 1 4
2 3 2 9 7
7 8 1 6 8 2

Subtest Visual Search

Record Time in minutes = seconds

Administer all items to all subjects

There is not time limit.

Time (Min=Sec)

1. ______ = ______
2. ______ = ______
3. ______ = ______
4. ______ = ______
5. ______ = ______
6. ______ = ______
7. ______ = ______
8. ______ = ______
9. ______ = ______
10. ______ = ______

Time (Min=Sec)

11. ______ = ______
12. ______ = ______
13. ______ = ______
14. ______ = ______
15. ______ = ______
16. ______ = ______
17. ______ = ______
18. ______ = ______
19. ______ = ______
20. ______ = ______

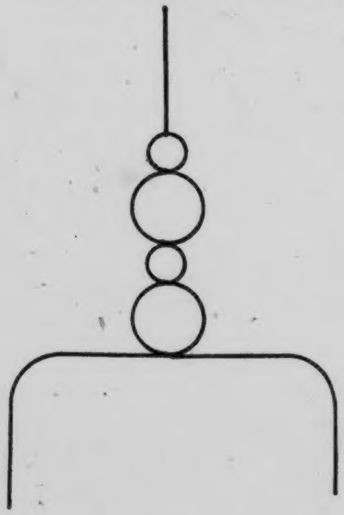
Examiner comments:

APPENDIX C

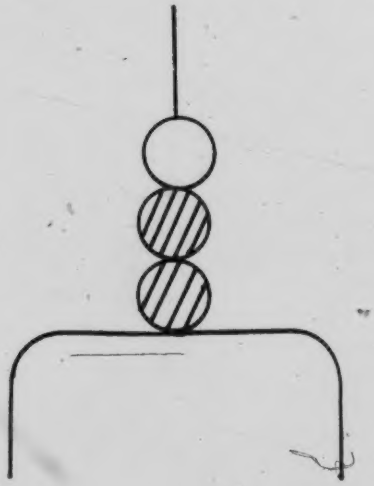
THE CAP TASKS

TASK 10 BEAD THREADING - EXAMPLES OF SEQUENCES

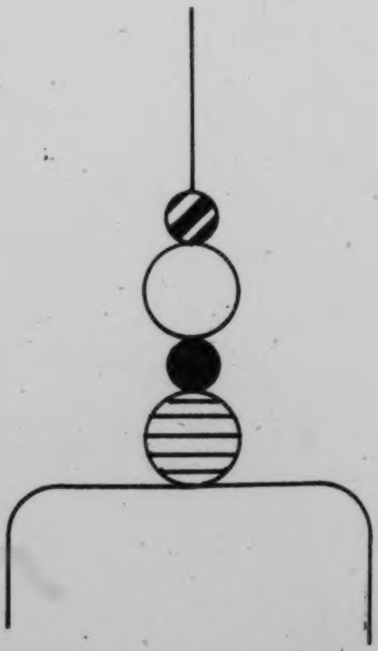
Level □
(Same Color of Beads)



Level △
(Same Size of Beads)



Level ○
(Different Size of Beads)



TASK 10 BEAD THREADING (WATCH-IT) - SAMPLE SEQUENCES

LEVEL 1 (▭) SAME COLOR

1.1 small, small

1.2 small, large

1.3 large, small

1.4 small, large, small

1.5 large, large, small

1.6 large, large, large

1.7 small, small, small, large

1.8 large, large, small, small

1.9 large, small, large, small

2 1.10 small, small, large, small, small

1.11 large, small, small, large, small

1.12 large, small, small, small, large

1.13 small, large, small, large, small, large

1.14 small, small, small, large, small, small

1.15 large, large, small, small, large, small

LEVEL 2 (△) SAME SIZE

2.1 red, blue

2.2 green, yellow

2.3 yellow, yellow

2.4 red, green, blue

2.5 yellow, blue, yellow

2.6 green, green, red

2.7 red, blue, red, blue

2.8 green, yellow, yellow, green

2.9 blue, blue, blue, red

2.10 green, yellow, green, yellow, green

2.11 blue, yellow, red, blue, yellow

2.12 red, green, green, green, red

2.13 green, yellow, red, green, yellow, red

2.14 blue, blue, red, red, yellow, yellow

2.15 green, red, yellow, yellow, red, blue

LEVEL 3 (○) DIFFERENT SIZE AND COLOR

3.1 large red, small yellow

3.2 small blue, large green

3.3 small green, small red, large blue

LEVEL 3 (○) (cont.)

3.4 large blue, small green, small green

3.5 large red, small blue, large red

3.6 small red, small blue, small green, large red

3.7 large red, large red, small green, large green

3.8 large blue, small green, large red, small green

3.9 large green, small red, large green, small blue, large green

3.10 small blue, small yellow, large red, small blue, small yellow

3.11 large blue, large green, large yellow, small red, small red

3.12 small blue, small yellow, small red, large blue, large yellow, large red

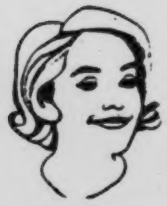
3.13 small green, large red, small green, large blue, small green, large red

3.14 large green, large red, small blue, small red, large yellow, large red

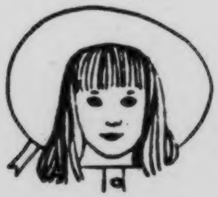
3.15 small red, small blue, large green, large red, small yellow, large blue

TASK 11 SERIAL RECALL - EXAMPLES OF SEQUENCES

Level 1 (□) SEQUENCE 1.3

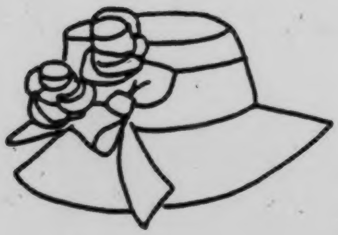


1

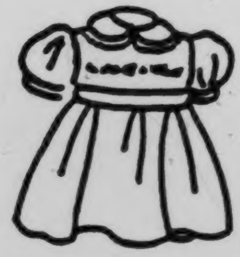


2

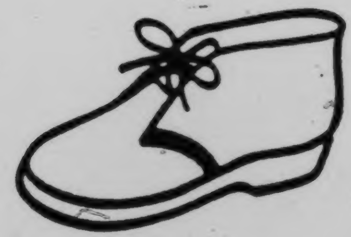
Level 2 (△) SEQUENCE 2.3



1

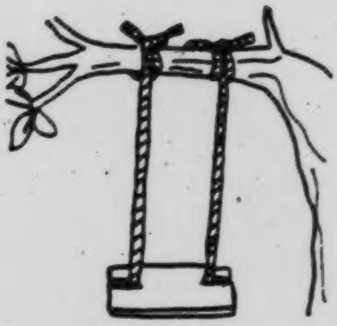


2

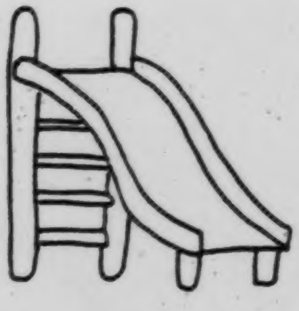


3

Level 3 (○) SEQUENCE 3.2

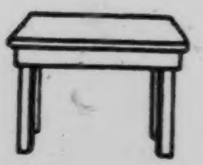


1

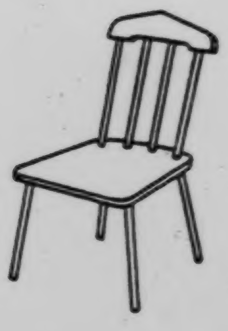


2

3

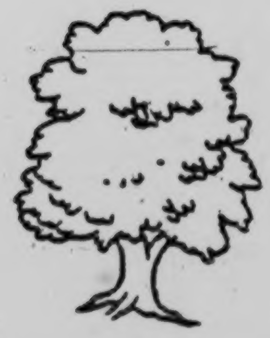


4

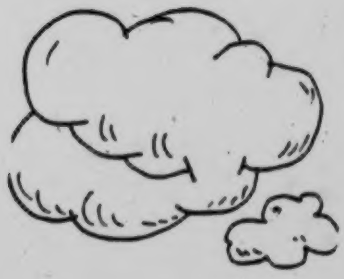


Level 4 (○) SEQUENCE 4.1

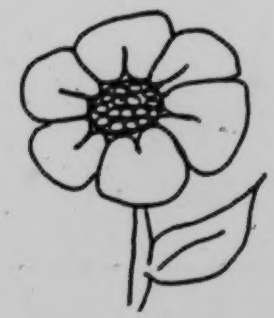
1



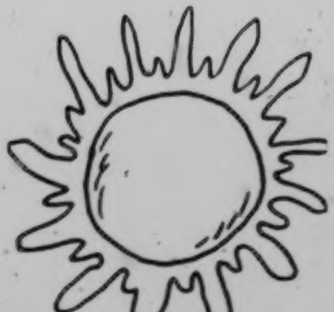
2



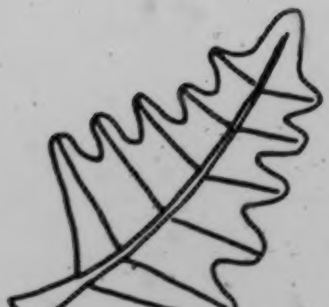
3



4

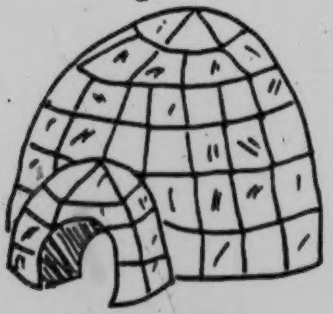


5

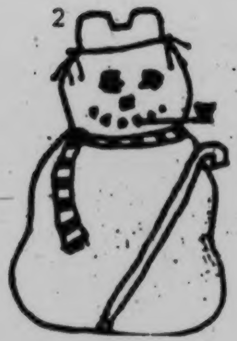


Level 5 (◇) SEQUENCE 5.3

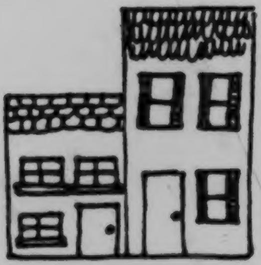
1



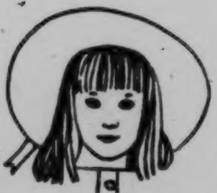
2



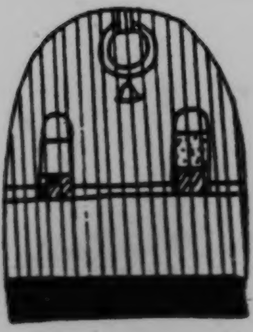
3



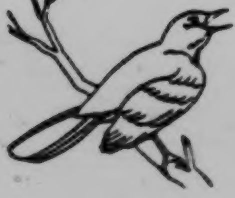
4



5

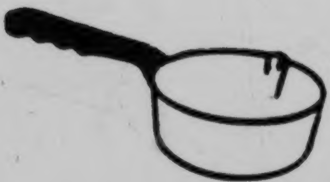


6

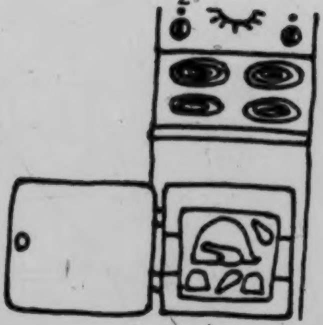


Level 6 (♡) SEQUENCE 6.3

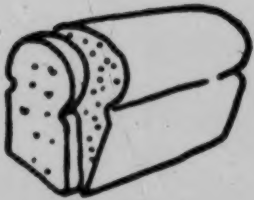
1



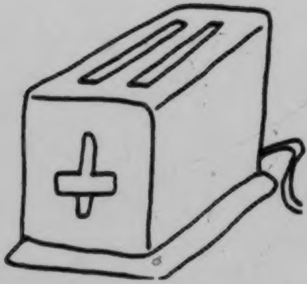
2



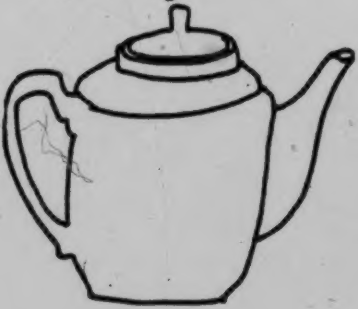
3



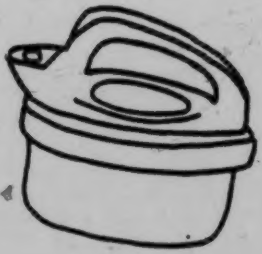
4



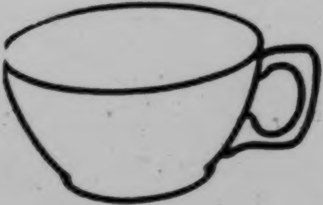
5



6

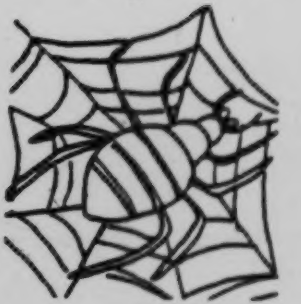


7

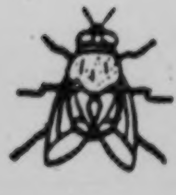


Level 7 (+) SEQUENCE 7.3

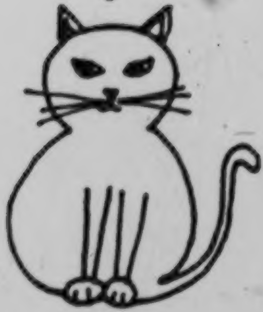
1



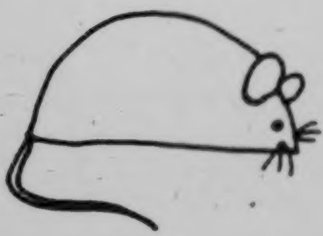
2



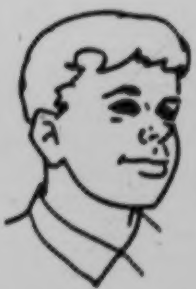
3



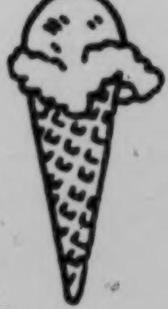
4



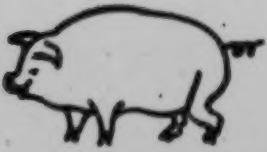
5



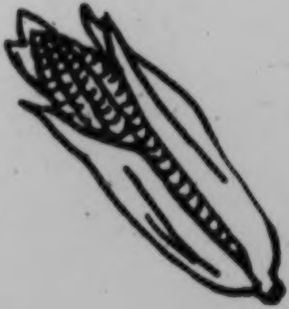
6



7



8



TASK 11 SERIAL RECALL (RECALL IT) - SAMPLE SEQUENCES

LEVEL 1 (□)

1.1 match, fire
1.2 bird, tree
1.3 lady, girl

LEVEL 2 (△)

2.1 knife, spoon, fork
2.2 baby, boy, man
2.3 hat, shoe, dress

LEVEL 3 (○)

3.1 man, apple, old-man, grapes
3.2 swing, slide, table, chair
3.3 girl, book, boy, kite

LEVEL 4 (⬡)

4.1 tree, cloud, flower, sun, leaf

4.2 helicopter, airplane, rowboat, yacht

4.3 pig, sheep, hat, helmet, bed

LEVEL 5 (◇)

5.1 torch, lamp, flower, plant, dress, skirt

5.2 tree, axe, log, pie, knife, slice-of-pie

5.3 igloo, snowman, house, lady, cage, bird

LEVEL 6 (♡)

6.1 sock, cherry, boot, strawberry, shoe, orange, joggers

6.2 bread, cake, pie, umbrella, rain, hat, sun

6.3 pot, stove, bread, toaster, teapot, kettle, cup

LEVEL 7 (+)

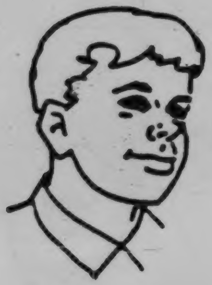
7.1 kite, sun, butterfly, helicopter, cloud, bird, rainbow, fly

7.2 rocket, space-scene, sun, moon, tractor, farmer, rooster, pig

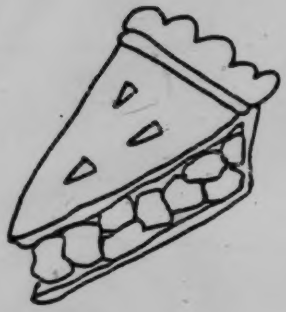
7.3 spider, fly, cat, mouse, boy, icecream, pig, corn

TASK 13 SYNTAX TASK - EXAMPLES OF SEQUENCES

Level 1 (□) (2 pictures) SEQUENCE 1.2

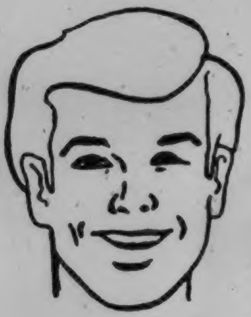


1

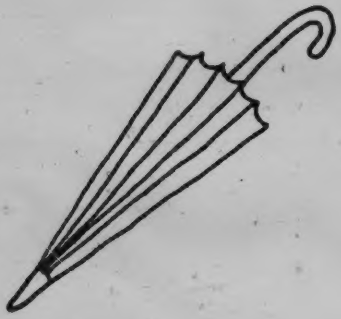


2

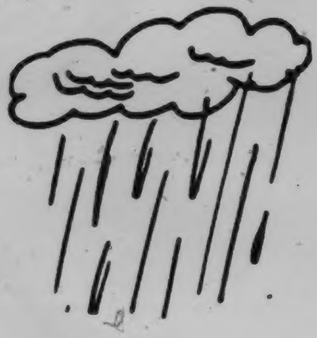
Level 2 (△) (3 pictures) SEQUENCE 2.5



1

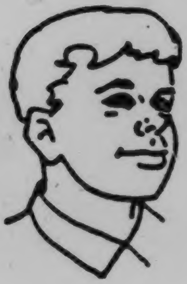


2

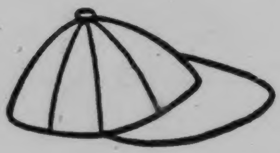


3

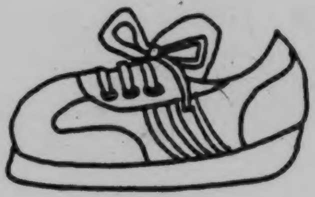
Level 3 (○) (4 pictures) SEQUENCE 3.1



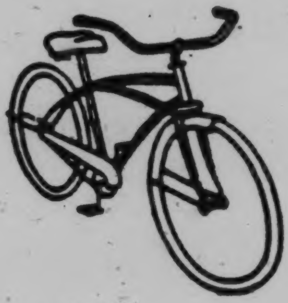
1



2



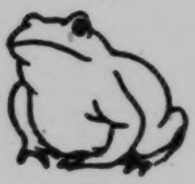
3



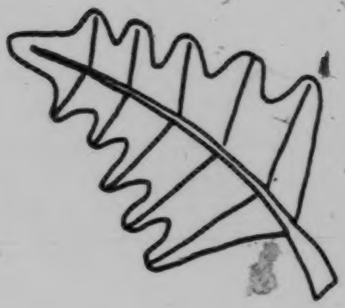
4

Level 4 (○) (5 pictures) SEQUENCE 4.5

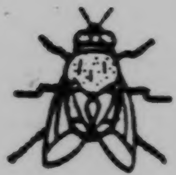
1



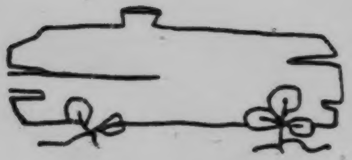
2



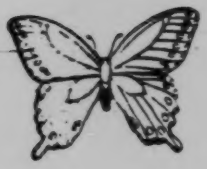
3



4

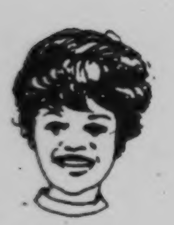


5

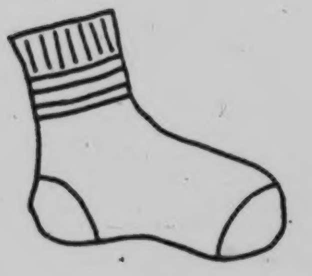


Level 5 (◊) (6 pictures) SEQUENCE 5.4

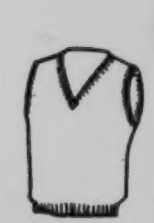
1



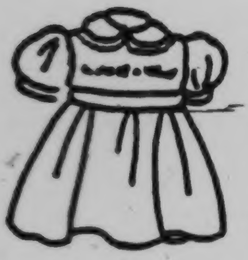
2



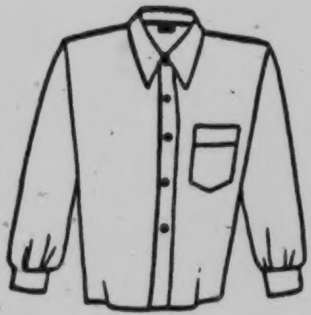
3



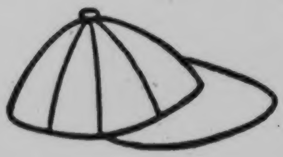
4



5

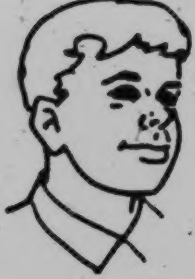


6

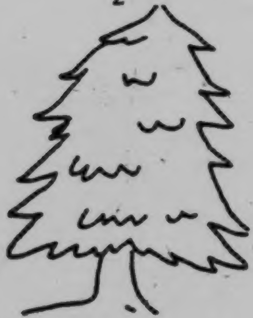


Level 6 (♡) (7 pictures) SEQUENCE 6.1

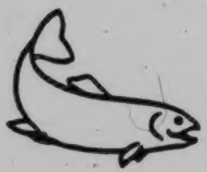
1



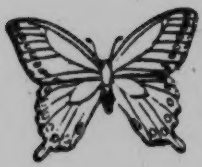
2



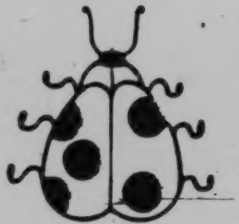
3



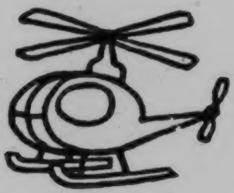
4



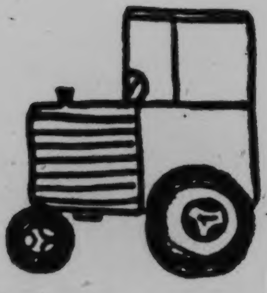
5



6



7



TASK 13 SYNTAX TASK (SHOW IT) - SAMPLE SENTENCES

LEVEL 1 (□) (2 pictures)

1.1 The **baby** is in the **cot.**
1.2 The **boy** eats a **piece of pie.**
1.3 The **old man** sits by the **fire.**
1.4 The **hen** is sitting on the **fence.**
1.5 The **cat** is chasing the **butterfly.**
1.6 The **bird** is building a **nest.**
1.7 The **girl** is reading a **book.**
1.8 The **lady** is cooking a **cake.**
1.9 A **snake** is under the **log.**
1.10 The **kite** is caught in the **tree.**

LEVEL 2 (△) (3 pictures)

2.1 The **boy** at some **chicken** and then he ate some **corn.**
2.2 The **man** talked to the **lady,** then he picked up the **telephone.**
2.3 The **lady** picked up the **bread,** then she picked up the **basket.**

LEVEL 2 (△) (cont.)

2.4 **Mum** picked up the **pot,** then she turned on the **stove.**

2.5 The **man** stood outside, then it started to **rain,** then he got out his **umbrella.**

LEVEL 3 (○) (4 pictures)

3.1 The **boy** put on his **cap,** then he put on his **runners,** then he got his **bike.**

3.2 The **farmer** saw the **pears,** then he got his **ladder,** then he put it against the **tree.**

3.3 The **girl** read a **book,** then the **cat** sat on her lap, then she sat by the **fire.**

3.4 The **man** got a **saw,** then he got a **hammer,** then he put them on the **table.**

3.5 The **girl** made a **cake,** then she made a **pie** ,then she made a **hamburger.**

LEVEL 4 (◇) (5 pictures)

4.1 The **lady** got her **handbag**, then she found her **basket**, then she found her **key**, then she picked up her **umbrella**.

4.2 The **children** made a **snowman**, then they put a **hat** on him, then they gave him a **carrot** for a nose, then the **sun** came out.

4.3 The **lady** picked some **flowers**, then she shook the **mat**, then she put up a **picture**, then she made the **bed**.

4.4 The **farmer** took his **axe**, then he got the **saw**, then he cut down the **tree**, then he built a **fence**.

4.5 The **frog** sat on a **leaf**, then it caught a **fly**, then it jumped onto a **log**, then it caught a **butterfly**.

LEVEL 5 (◇) (6 pictures)

5.1 A **girl** caught a **butterfly**, then put it in a **jar**, then she put in some **leaves**, then she took them into the **house**, then she showed her **brother**.

LEVEL 5 (◊) (cont.)

5.2 The **girl** took a **basket,** then she put in some **chicken,** then she put in an **apple,** then she put in some **bread,** then she put in some **cake.**

5.3 The **man** came **home,** then he took off his **shoe,** then he had a **drink,** then he sat in the **chair,** then he read a **book.**

5.4 **Mum** mended a **sock,** then she sewed a **shirt,** then she knitted a **vest,** then she made a **cap.**

5.5 The **man** bought a **Christmas stocking,** then he put in a **ball,** then he put in a **party hat,** then he put in a **comb,** then he put in a **flashlight.**

LEVEL 6 (♡) (7 pictures)

6.1 The **boy** was sitting under a **tree,** then he caught a **fish,** then he saw a **butterfly,** then he saw a **ladybird,** then he saw a **helicopter,** then he saw a **tractor.**

6.2 The **boy** stood up, then he put on a **boot,** then he got his **bucket,** then he went to pick an **apple,** then he picked a **pear,** then he picked an **orange,** then he picked a **banana.**

LEVEL 6 (♡) (cont.)

6.3 At the zoo I saw a **koala,** then I saw an **elephant** then I saw a **rabbit,** then I saw a **snake.**

6.4 I went for a ride in a **rocket,** then I went in a **car,** then I went in a **rowboat,** then I went in an **airplane,** then I went in a **tip-truck,** then I went in a **train,** then I went in a **yacht.**

6.5 I went for a ride on a **tractor,** then I saw a **horse,** then I saw a **pig,** then I saw a **hen,** then I fed a **cat,** then I played with a **dog,** then I saw a **sheep.**

TASK 16 TELEPHONE - SAMPLE SEQUENCES

Level 1 (□) (3 digit sequence)

9 - 3 - 5

Level 2 (△) (4 digit sequence)

6 - 3 - 5 - 1

Level 3 (○) (5 digit sequence)

5 - 7 - 1 - 8 - 2

Level 4 (⬡) (6 digit sequence)

4 - 9 - 2 - 6 - 1 7

Level 5 (◊) (7 digit sequence)

3 - 6 - 1 - 4 - 8 - 5 - 2

Level 6 (♡) (8 digit sequence)

7 - 9 - 2 - 5 - 6 - 4 - 3 - 1

Level 7 (+) (9 digit sequence)

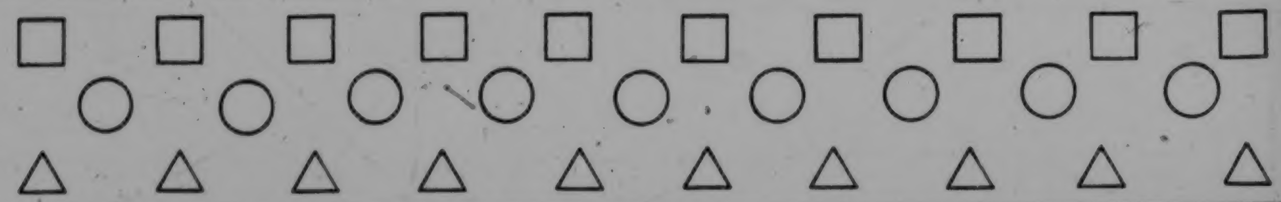
2 - 1 - 8 - 5 - 7 - 4 - 6 - 9 - 3

TASK 18 JOINING SHAPES (JOIN IT) - SAMPLE SEQUENCES

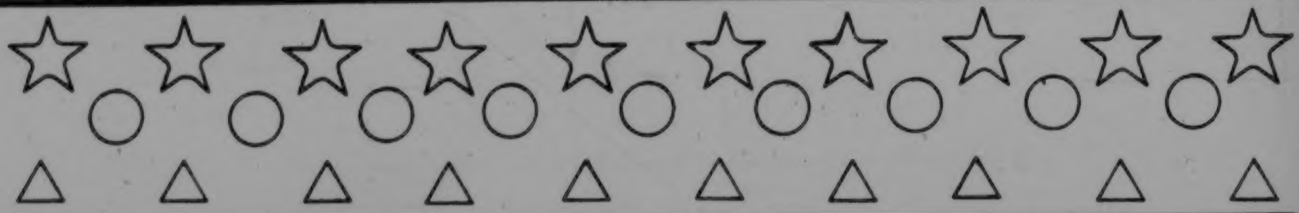
Each sequence corresponds to the same numbered pattern on the attached pattern pages. The pattern pages may also be used for any other patterns sequences you create.

1. Join a □ to a ○ to a △ then back again.
2. Join a ☆ through two ○ to a △ then back again.
3. Join a ⬠ to a ⬠ through one other shape.
4. Join two ▽ to two ○ to two ◊ .
5. Join □ to ○ , missing all the ▽ .
6. Join a △ to a △ through two other shapes.
7. Join a ☆ to a ⌓ through two other shapes.
8. Join two ⬯ to a ◇ then to a ○ .
9. Join a ○ to a ○ through two other shapes.
10. Join a ⬡ to a ⋀ to a ▽.
11. Join a ▱ to a ⬯ then a ▱ to a ○.
12. Join ⛉ to ⬠ then ⛉ to ⋀.

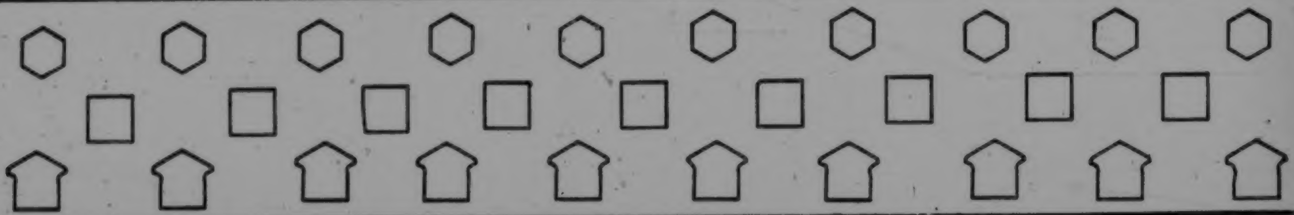
1.



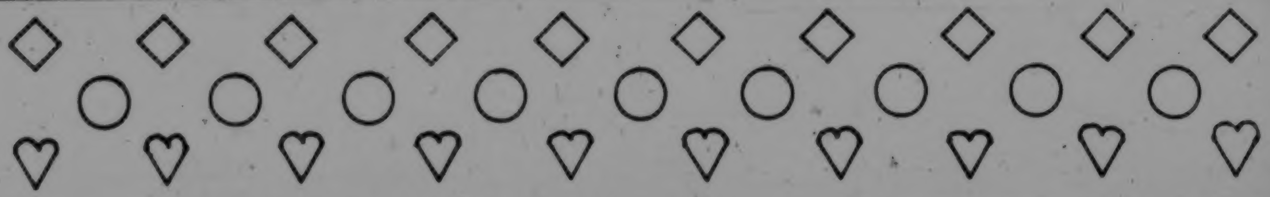
2.



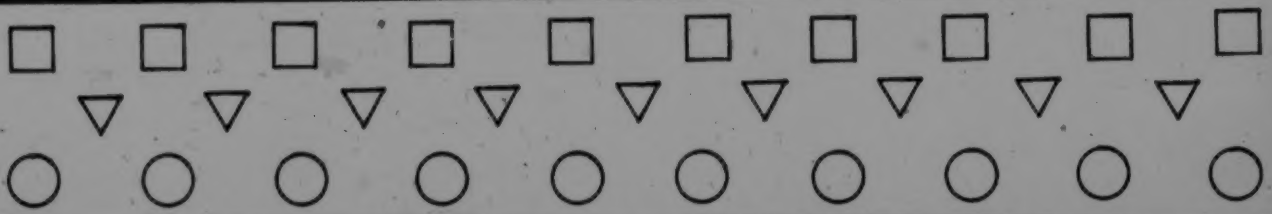
3.



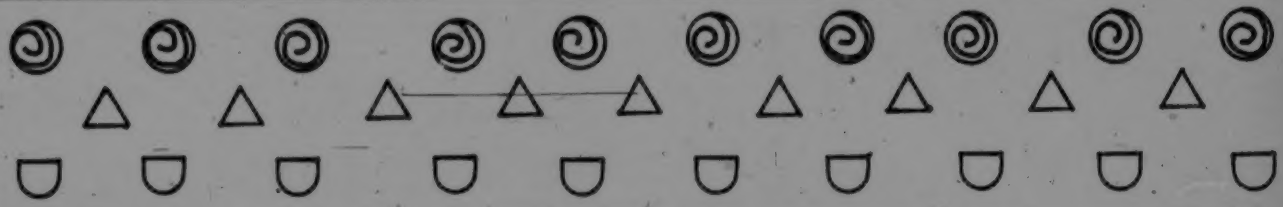
4.



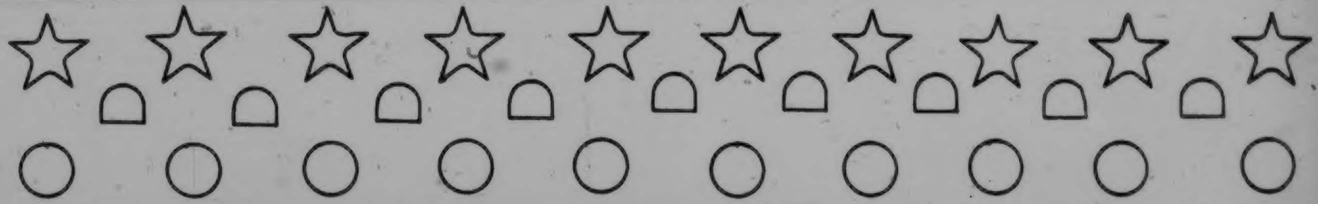
5.



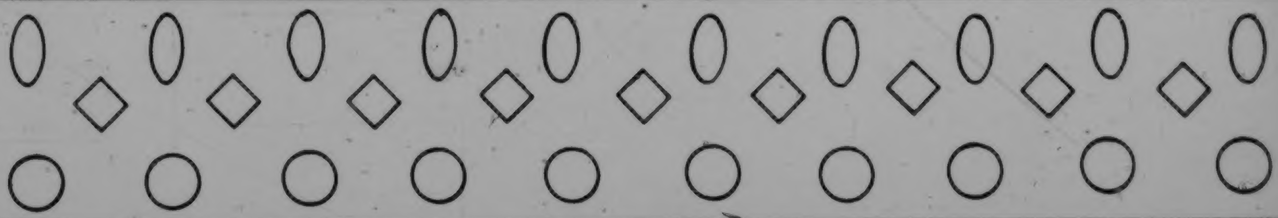
6.



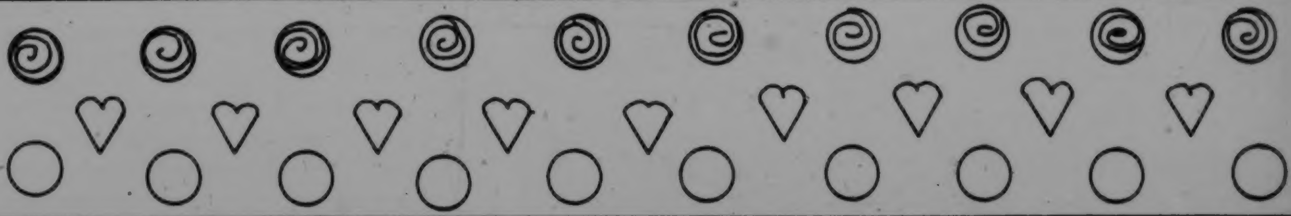
7.



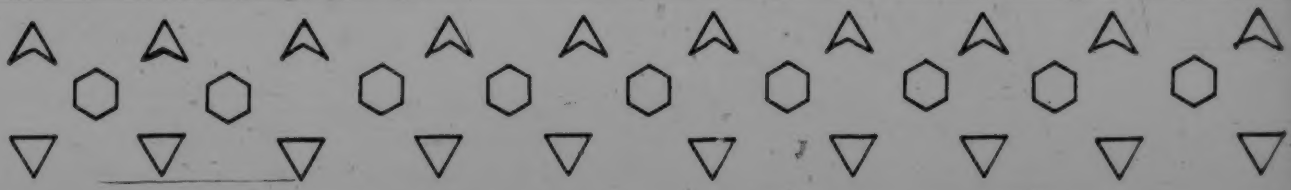
8.



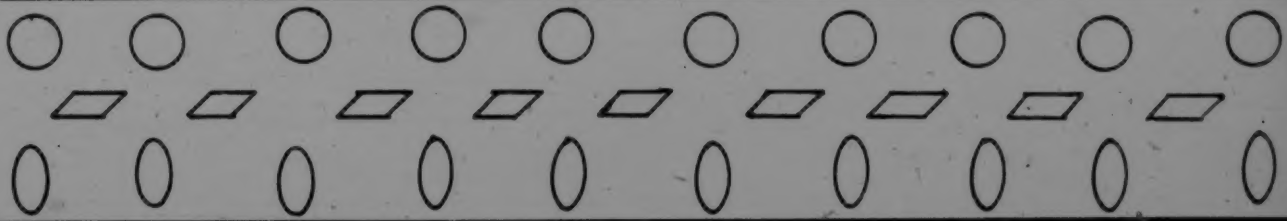
9.



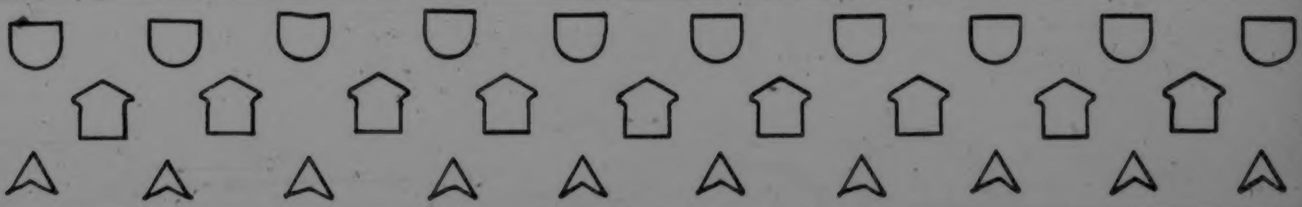
10.



11.



12.



APPENDIX D

SAMPLES OF STUDENTS' WRITTEN EXPRESSION

Student A
Writing Sample taken in September

I went to my Gramu
haftr I went to my daswck

Evaluation:	- Medium - Grade 1
Content:	- who and what are included - contains few details but conveys meaning
Organization:	- some concept of sequencing is demonstrated - story makes sense
Sentence Structure:	- simple sentences
Vocabulary:	- use of words is sufficient to convey meaning
Conventions:	- using capital letters - uses inventive spelling which is often decipherable.

Student A
Writing Sample taken in April

I hat spidrs the spidrs
scard the man a wua the man rar
on the gras and he went to
his huome to get his gun
and he went bac to shot
the big spidr and he wet
bac to his huome and
he wet to slep the end.

Evaluation:	- Medium - Grade 2
Content:	- identifies a problem and solves
Organization:	- concept of sequencing is evident (beginning-middle-end)
Sentence Structure:	- use of common connective "and" - simple sentences
Vocabulary:	- straight forward description
Conventions:	- makes good guesses at spelling words

Student B
Writing Sample taken in September

I wuse eating my lunck wen
travscam and got me I went
outsid and my bike wuz brocan
I Got to taik it in the shooel.

Evaluation:	- Low - Grade 2
Content:	- identifies characters and setting - identifies a probelm and solves it
Organization:	- consistently uses a narrative plot ("I") - sequence involves ordering by cause and effect
Sentence Structure:	- common connective "and" is used - subordination (when) - uses primarily simple sentences
Vocabulary:	- writes a straight forward description
Conventions:	- makes good guesses at spelling words

Student B
Writing Sample taken in April

One day Jon was camping in
tarantula cunter. he went
for a stroll in the wood. And
then he saw a tarantula in sum
booshis. and then Jon went runing
up the hill and called the
tarantula catchsr and catchs
the tarantud and John
was glad Jon never campt
they agen Jon told people abot
the campsit. He told hes best
frend a botit. And he went
to it.

See following page for Evaluation

Evaluation:	- Low - Grade 3
Content:	- The who, what, where and when are includied in the story
Organization:	- the story involves a sequence of cause and effect
Sentence	- uses simple sentences with common connective (and)
Vocabulary:	- evidence of developing a more precise vocabulary (stroll)
Conventions:	- evidence of more consistent use of punctuation and capitalization